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ABSTRACT

Issue 1 and 2 is a special issue devoted to the cultural-historical school of thought about mental development based on the work of Lev Vygotsky. The four articles that discuss a cross section of issues from the Vygotskyan Paradigm are as follows: "Mind as a Cultural Achievement: Implications for IQ Testing" (Michael Cole); "Children's Social Worlds: An Ethnic View" (Rosi A. C. Andrade and Luis C. Moll); "Working with a Teacher in the Zone of Proximal Development: Action Research (Gordon Wells); and "Book Review of Tharp and Gallimore's "Rousing Minds to Life: Teaching, Learning and Schooling in Social Context" (Robert Rueda). Four articles on aspects of accelerative learning are presented in Issues 3 and 4. "The 636% Solution Paradigm: A Statistical Evaluation of the Extraordinary Effectiveness of Lynn Dhority's U.S. Army Accelerated Learning German Class" (Lyelle Palmer, Lynn Dhority) describes a study using accelerated learning techniques. "A Re-Examination of North American Adaptations of Suggestopedia" (Jonathan Alderson) reports a study in which the pseudo-passive concert phase of the Lozanov method was used to aid study and memorization. In "The Contribution of Background Music to the Enhancement of Learning in Suggestopedia: A Critical Review of the Literature" (Uschi Felix), research on use of music within and outside the Lozanov method is examined. "The Effects of Music and Imagery on Learning and Attitudes in an Industry Training Class" (Valerie J. Eastman) explains a study in which experimental groups of students were exposed to music, imagery, music and imagery and the learning results compared with those of a control group. Volume indexes are also included. Each chapter contains references. (MSE)

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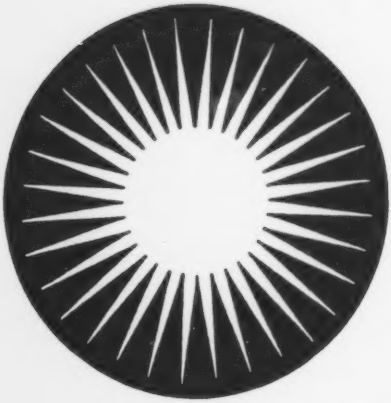

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SPECIAL ISSUE - A CULTURAL-HISTORICAL APPROACH TO LEARNING AND TEACHING: NEW PERSPECTIVES ON ADVANCING DEVELOPMENT

Introduction to the Cultural-Historical (CH) Model

Pedro Portes, Editor

For many readers of this journal, the present Special Issue might come as a surprise. This set of papers represents a totally different model of mental development than Lozanov's and a scientific tradition that is only beginning to be understood internationally. The present collection reflects also an effort to broaden the horizons of the journal by making it a truly open forum for innovative ideas that improve educational practice. For many, the idea of augmenting the scope of traditional educational practices has been precisely the motive for reading the journal. We hope that by bringing different views to bear on current educational problems, both the mission of our journal and education as a whole, can be best served.

This issue introduces the cultural historical school of thought founded by Vygotsky with his Russian colleagues and students, Luria and Leont'ev, among the most important. Lev S. Vygotsky was a contemporary of Jean Piaget and developed his own stage model of intellectual (concept) development independently of the biologically-oriented Swiss scholar. Vygotsky's contribution stands out today because he addressed the socio-cultural basis of higher level functions in a far more authoritative fashion than the existing psychological models. Unlike Piaget, he ascribed a much more influential role to human speech and other mediational tools in originating changes in cognition and in the "acceleration" of certain zones of intellectual development. Although his work was first introduced in the West long after his early death in 1936 by Jerome Bruner in 1962, and his second book, *Mind in Society* did not appear until 1978, the last decade has had a period of rapid dissemination and activity.

Since the first translation of Vygotsky's *Speech and Thought* in 1962, at least two newer translations have appeared along with many relatively "new" writings that have sparked a transformation in how the mind is to be studied. This first Special Issue represents not a departure from the tradition of JSALT, but rather an expansion that remains as avant garde as ever. The perspective reflected in this issue is one based not only on a brain-based model such as Lozanov's, but rather one also based on culture. Vygotsky's work is significant today because the problems that he addressed in his time are still most relevant in education and psychology. In focusing on the development of higher level intelligence, the processes that advance the growth of the human mind can be examined in terms of social contexts that propel the development of children's minds. This model provides clear implications for educational reform and for the development or "acceleration" of intellectual and other skills.

The lead article in this issue begins with an historical introduction to the interrelatedness of the human mind, and how it has been traditionally been conceptualized and assessed. In this paper, the idea that higher-level intelligence is an achievement that depends on cultural conditions is explored historically and illustrates the Vygotskyan model. With an eye toward educational challenges in the next century, Michael Cole traces current conceptions of intellectual development and uncovers some of the important issues that confront us in organizing education intelligently. His essay provides an introduction also to the cultural historical model and provides a glimpse of how activity-oriented schooling is related to advances in learning and teaching, and indirectly links it to many of the successes found in accelerated learning methods from a theoretical standpoint.

In the next paper, Andrade and Moll present a perspective on childhood that allows for a dynamic understanding of how children's minds are constructed in a social context. They employ a method that allows for both objective and subjective perspectives on childhood and for the study of various factors that constitute the social context of development. Their case study underlies the importance of understanding the mediators that account for normative and exceptional patterns of development alike. Their study illustrates one of the many existing approaches within the cultural historical model that address the context of human activity as part of understanding individual growth.

In the last paper in this collection, Gordon Wells ventures in the area of teacher education in another case study that illustrates key problems in this particular but strategic field. The incorporation of theory into the very formation of future educators provides a backdrop for understanding how concepts such as the "zone of proximal development" and others are being assimilated gradually into the center of educational activities.

And finally, Rueda's book review of *Rousing Minds to Life* by Roland Tharp and Ronald Gallimore caps the issue with an incisive analysis of one of the most important contributions to the field of education. Tharp & Gallimore have elaborated a theory-driven approach to restructuring education that has not only been successful in Hawaii, but one that serves to orient many of the current, fragmented school-based interventions found currently.

In sum, these selected writings comprise a unique volume that is aimed to disseminate not only ideas of relevance for educational practice, but a cross section of issues that can be addressed from the Vygotskyan paradigm. The latter is currently being expanded vigorously at an international level. It is likely that this cultural approach to human development, along with advances in biological knowledge, will guide us through a whole range of educational problems into the 21st century.

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Mind as Cultural Achievement: Implications for IQ Testing*

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Abstract. Some psychologists claim to have constructed "culture free" tests to provide an unbiased measure of individual ability by sampling from universals in human experience. The author works through a thought experiment to argue that culture-free intelligence is a contradiction in terms, and presents several cases to point out that a culturally sensitive teacher is an indispensible ingredient of successful teaching with culturally diverse students.

* * * * *

For almost as long as there have been IQ tests, there have been psychologists who believe that it is possible to construct

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"culture free" tests. The desire for such tests springs directly out of the purposes for which tests of general intellectual ability were constructed in the first place: to provide a valid, objective, and socially unbiased measure of individual ability. Our society, founded upon the principle that all men are created equal, has never lived easily with the recognition of enormous de facto social inequality. We need a rationale for such inequality and our traditions strongly bias us to seek the causes of inequality, in properties of the individual, not society. At the same time, we realize that social and economic inequality can be the causes of individual intellectual inequalities, as well as their consequences.

What would be more ideal, then, than a psychological test that could measure intellectual potential that is based equally on the experience of people from all cultures? Can't we find universals in human experience and construct a test on this basis? Some psychologists (Jensen, 1979) have claimed not only that such tests are possible in principle, but have been applied in practice.

In this paper I will argue that culture-free intelligence is a contradiction in terms.

After working through a "thought experiment" to help clarify the issues, I will turn to some implications for teaching of the view that mental development is always a culturally organized process that can produce great heterogeneity in specific mental skills by the time children reach school. This heterogeneity can cause great difficulties for the classroom teacher. In the final section I will note some promising leads that teachers may use in dealing with culturally organized heterogeneity in their classrooms.

Having made these assertions, I want to provide the evidence upon which they are based. My own personal strategy for thinking about these matters is to think my way back in time into the nineteenth century when such devices came into existence. I have found it helpful to study the conditions in science and society that allowed some scholars to believe it is possible to assess mind independently of culturally organized experience. To begin, I will review some of that history, emphasizing the logic of the enterprise. I am focusing on an *anthropological* perspective on testing, but it should become clear that anthropology and psychology have always been linked in shaping our understanding of the relation between experience and mind, even when this link is obscured by divergent methods and theories.

The several decades just preceding this century provide a useful starting point from which to trace theories of culture and cognitive development, because it was during this period that both anthropology and psychology took shape as disciplines. Before that time, say the 1860's, there was no distinctive body of methods for the study of the "humane sciences," nor had scholars with different theories been institutionally divided into separate disciplines the way they are today. Obvious differences in technological achievement between people living in different parts of the world were common knowledge. Theorizing about sources of these differences had produced rather general acceptance of the notion that it would be possible to study the history of humanity by a study of contemporary peoples at different "levels of progress." E. B. Tylor (1958, p. 69) summarized, in what he calls "mythic fashion," the general course of culture that most of his fellow scholars would have adhered to:

> We may fancy ourselves looking on Civilization, as in personal figure she traverses the world; we see her lingering or resting by the way, and often deviating into paths that bring her toiling back to where she had passed by long ago; but direct or devious, her path lies forward, and if now and then she tries a few backward steps, her walk soon falls into a helpless stumbling. It is not according to her nature, her feet were not made to plant uncertain steps behind her, for both in her forward view and in her onward gait she is of truly human type.

Tylor's choice of imagery for "Civilization" nicely reveals another basic assumption which he and many of his colleagues made: there is no principled distinction between mind and society. The condition of culture among the various societies of mankind, Tylor tells us, reveals basic information about the laws of human thought. He even adopted the notion of a "mental culture," which he expected to be high or low depending upon the other conditions of culture with which it was associated.

Herbert Spencer, writing at about the same time, shared Tylor's belief in the fusion of mental and cultural phenomena. He also drew a very tight analogy between cultural development on the one hand and mental development on the other.

> During early stages of human progress, the circumstances under which wandering families and small aggregations of families live furnish experiences comparatively limited in their numbers and kinds; and consequently there can be no considerable exercise of faculties which take cognizance of the *general truths* displayed throughout many special truths. (Spencer, 1886, p. 521).

Spencer invites us to consider the most extreme case; suppose that only one experience were repeated over and over again, such that this single event comprised all of the person's experiences. In this case, as Spencer put it, "the power of representation is limited to reproduction of this experience" in the mind. There isn't anything else to think *about*! Next we can imagine that life consists of two experiences, thus allowing at least elementary comparison. Three experiences add to the elementary comparisons, and elementary generalizations that we make on the basis of our limited (three) experiences. We can keep adding experience to our hypothetical culture until we arrive at the rich variety of experiences that characterizes our lives. It follows from this line of reasoning that generalizations, the "general truths" attainable by people, will be more numerous and more powerful the greater one's experience. Since cultures provide experience, and some cultures (Spencer claimed) provide a greater diversity of experience than others, a neat bond between cultural progress and mental progress is cemented.

Although such evolutionary schemes seemed almost transparently obvious in the enthusiasm following publication of Darwin's *Origin of Species,* events toward the close of the nineteenth century proved that there could be a great deal of disagreement about the relation between culture and thought, despite the compelling story constructed by people like Tylor and Spencer. One set of disagreements arose when scholars started to examine more closely the data used to support conclusions about relations between cultures, especially claims for historical or evolutionary sequences. Quite a different set of arguments arose around conflicting claims about mental processes.

The seed of disagreements concerning cultural sequences can be found in Tylor's own work (1958). The main criteria for judging the stage of a culture were the sophistication of industrial arts (including manufacturing techniques for metal tools, agricultural practices) and "the extent of scientific knowledge, the definitions of moral principles, the conditions of religious belief and ceremony, the degree of social and political organization, and so forth." However, in Tylor's words, "If not only knowledge and art, but at the same time moral and political excellence, be taken into consideration" it becomes more difficult to scale societies from lower to higher stages of culture.

This latter theme in Tylor's work was taken up by Franz Boas (1911), who submitted the cultural evolution position to a devastating critique at the close of the nineteenth century. On the basis of his own ethnographic work, Boas concluded that a great deal of the evidence apparently supportive of evolutionary schemes was so deeply flawed that no clear conclusions ranking one culture above another could be accepted. Boas did more than show the flaws in evolutionists' data and arguments concerning culture; he also delighted in showing that examples of "primitive mind" produced as part of this argument were based on misunderstandings. Consider the following example from Boas's classic (1911), *The Mind* *of Primitive Man*, which repeats evidence used by Spencer to make some generalizations about properties of primitive mind:

> In his description of the natives of the west coast of Vancouver Island, Sproat says, "The native mind, to an educated man, seems generally to be asleep.... On his attention being fully aroused, he often shows much quickness in reply and ingenuity in argument. But a short conversation wearies him, particularly if questions are asked that require efforts of thought or memory on his part. The mind of the savage then appears to rock to and fro out of mere weakness."

Spencer's text goes on to cite a number of similar anecdotes corroborating this point. But Boas (1911) produces an anecdote of his own.

> I happen to know through personal contact the tribes mentioned by Sproat. The questions put by the traveler seem mostly trifling to the Indian, and he naturally soon tired of a conversation carried on in a foreign language, and one in which he finds nothing to interest him. As a matter of fact, the interest of these natives can easily be raised to a high pitch, and I have often been the one who was wearied out first. Neither does the management of their intricate system of exchange prove mental inertness in matters which concern them. Without mnemonic aids to speak of, they plan the systematic distribution of their property in such a manner as to increase their wealth and social position. These plans require great foresight and constant application.

Thus, Boas tells us that the entire scheme was wrong. Cultures cannot be ranked using evolutionary age as a basis for comparison, and "mind" cannot be seen as rank in developmental age. (Boas also demonstrates the total hopelessness of deducing cultural differences from any differences, real or imagined, in genetic makeup.)

Finally, and very importantly, Boas was a leader in a subtle, but essential change in anthropological thinking about the concept of culture itself. Educated in Germany, Boas had begun his career imbued with the romantic concept of "Kultur", the expression of the highest attainments of human experience, as expressed in the arts, music, literature, and science. This is the conception of culture that allowed Tylor to talk about "the conditions of culture among various societies." Tylor, like Boas as a young man, conceived of culture as something groups and individuals had more or less of. It was a singular noun: one talked of higher or lower *culture*, not more or fewer *cultures*. By the same route that led him to deny the basis for ranking cultures in terms of a hypothetical, evolutionary sequence, Boas arrived at the idea that different societies create different "designs for living," each representing a uniquely adapted fit between their past and their present circumstances in the world. This point of view is central to anthropology, and it clearly has to be taken into account if we want to rank the intellectual achievements (levels of mental development) of people growing up with different cultural experiences. It renders simple more/less comparisons of cultures difficult and restricted, with parallel effects on our inferences about mind.

Enter Psychology

As we entered the twentieth century, anthropology was still pursuing its goal of reconstructing the history of mankind by studying cultures in different parts of the world. But that goal was now blocked by serious methodological problems (such as those raised by Boas) that needed to be settled before further theoretical progress could be made.

The birth of psychology is usually dated back to 1879, when Wilhelm Wundt officially opened an experimental laboratory in Leipzig. The exact date is not important, because several laboratories opened almost simultaneously in different industrialized countries. But the reasons for these laboratory openings are very important indeed.

Boas's critique of developmental theories, whether of mind or culture, produced controversy in both domains of inquiry. Boas earned the enmity of anthropologists who believed his criticisms of their general theories unjust; they sought to rescue the more general theories, criticizing Boas and his students for "historical particularism" (to use Harris's apt phrase). While new competitors for an overall approach to understanding historical links between cultures became a central activity for the new discipline of anthropology, psychologists were people who took up the other half of Boas's critique, problems of specifying mental mechanisms.

The major difficulty facing those who became psychologists was to devise methods for specifying pretty exactly what sorts of activity an individual engages in at those times we want to make claims that some sort of "thinking" is going on. No one could be very precise about what was meant when psychologists referred to a mental process. Competing claims were evaluated by constructing settings to control as exactly as possible the kinds of events a person experienced and to record the kinds of responses these experiences evoked. Since the presumed processes were not observable (they were, as we say, "psychological"), psychologists spent a great deal of time and ingenuity devising ways to pin down what these non observable processes might be. The rapidly growing ability to control electricity and to build precision machinery was exploited to the fullest; the early psychology laboratories were marvels of inventions. Their instruments allowed psychologists to present people carefully controlled lights and tones for carefully controlled intervals, and to measure precisely the time it took to respond. In their search for ways to make mind observable, they used electrophysiological devices to record internal, organic functioning. The discipline of "psychophysics" advanced appreciably in its quest to relate psychological phenomena of an elementary order (discriminating tones, judging hues). There was even hope of uncovering a "cognitive algebra" by carefully comparing reaction times to stimuli of various complexities arranged to reveal steps in the thought process.

The activities of the psychologist and the anthropologist soon contrasted very dramatically. The psychologist brought people into the laboratory where behavior could be constrained, stimuli controlled, and mind made visible. The anthropologist wandered the world talking to people, observing their customary behavior, and seeking clues about the factors that made one design for living different from another.

Whereas the anthropologists continued to concentrate on gathering data that would permit firm statements about historical relations between cultures, scholars who came to identify themselves as psychologists concentrated on resolving arguments about thinking, such as psychologists concentrated on resolving arguments about thinking such as those illustrated in the passage quoted from Boas. Just as anthropology evolved careful field techniques to disambiguate competing claims about "culture," psychologists developed the laboratory experiment as a way to test competing claims about "mind."

There occurred, in effect, a division of labor in the "humane sciences," a division that was primarily a matter of scientific strategy in the beginning: progress required some concentrated work on specialized subtopics. The overall task remained the same for everyone: how do human beings come to be the way they are?

Enter Testing

Despite an increasing gulf between scholars who called themselves psychologists and those who called themselves anthropologists, it was not long before these two areas of inquiry were brought together again. At the end of the nineteenth century, Francis Galton, in England, set out to test hypotheses about mental differences among people, using the newly devised psychological techniques. His concern was not differences between people growing up in different cultures. Rather, he studied people growing up in different families. He sought the inherited sources of variability in mental abilities. Significantly, his tests were theoretically motivated; he believed that speed of mental processing was central to intelligence so he created tests of rapid processing of elementary signals. Galton succeeded in finding differences among Englishmen on such tests as simple reaction time to a pure tone, but he did not succeed in relating these "psychological test" differences to human characteristics of greater interest to him such as scientific excellence or musical ability. Galton's tests, based on an oversimplified model of the human mind and the highly controlled procedures adopted from the laboratory appropriate to testing his theory, were not taken up by society. However, in creating an early precursor of existing IQ tests, Galton did begin the development of the statistical techniques that would be necessary to show how test differences correlate with interesting behavioral differences.

The difficulties that Galton encountered in trying to demonstrate that he was testing abilities of general significance were a direct stimulus to the development of that branch of applied mathematics known as statistics, upon which current testing technology relies so heavily. The fact that these difficulties have not been resolved, despite great progress in the technology for evaluating the theory, is a key problem that remains to be dealt with.

Galton did all of his work in England, but other Englishmen, including W. H. R. Rivers, traveled to the Torres Strait northeast of Australia, to see if psychological tests could be used to settle disputes over cultural differences in cognition. Rivers was in some senses an antique. He was both anthropologist and psychologist, which meant that he considered both the evidence of his tests and evidence provided by observation of the people he went to study when he made statements about culture and thought. His conclusions were consistent with Galton's data on individual differences; natives differed from each other on such simple tasks as their ability to detect a gap in a line, or their recognition of colors. But there were no impressive differences between the natives of the Torres Strait and Englishmen.

It would appear on the basis of this evidence that there are no cultural differences in thinking, at least no differences consistent with what we had been led to believe by Tylor, Spencer, and many others. However, it could be (and was) argued that the important ways in which cultural differences cause mental differences were not even tested by Rivers and his associates. After all, Galton had found no relation between responses to his psychological tests and other presumed indicators of intelligence. Why would anyone, then, expect cultural differences? Perhaps the experiments, limited as they were to *elementary* psychological processes, simply failed to implicate *higher psychological processes* at all. What we needed were tests of higher psychological processes that could be used to compare people from different cultures or different people in the same culture.

This distinction between elementary and higher processes pinpoints a weakness in the basic foundations of experimental psychology, a weakness acknowledged by Wundt, its founder. It is impossible, Wundt believed, to study *higher* psychological functions in experiments because it is impossible to construct appropriately controlled environments of the needed complexity. Wundt believed that scientists should use *ethnological* evidence and folklore if they want to discover the properties of the mind that get constructed on the basis of the elementary processes that he studied in the laboratory.

Wundt's doubts about the experimental method have not been accepted in psychology, but they are very germane to understanding problems with cross-cultural developmental research, as we shall see. These doubts were not accepted because they put psychologists in a very difficult bind. Psychology had been founded on the principle that without carefully controlled environments, it is not legitimate to make statements about how the mind works. A great many of the questions about how the mind works that interested psychologists and anthropologists alike clearly refer to "higher" psychological processes such as logical reasoning and inference. When Wundt gave up on the idea that such processes could be studied in the laboratory, he was, it seemed, robbing psychology of most of its interesting subject matter. For psychologists, the inability to study higher psychological processes in the laboratory meant that they could not be studied at all. Rejecting this conclusion, many psychologists were attracted to theories claiming that complex processes are compounded of simple ones. The basic task was to understand the elements before tackling the compound. Relatively simple experimental models thrived, but complex behavior was rarely dealt with.

Binet's Strategy

The major push for research on more complex human problem solving came from a source seemingly outside the scientific community, although respected psychologists were involved. Early in this century, Alfred Binet was asked to deal with a practical, social problem. With the growth of public education in France, there was a growing problem of school failure, or at least severe school under-achievement. It seemed not only that some children learned more slowly than others, but that some children, who otherwise appeared perfectly normal, did not seem to benefit much from instruction at all. Binet and his colleagues were asked to see if they could find a way to identify slow-learning children at an early stage in their education. If such identification were possible, special education could be provided them, and the remaining children could be more efficiently taught.

The subsequent history of IQ testing has been described too frequently to bear repetition here, but a sketch of the basic strategy of research is necessary as background to understand just how deeply IQ tests are embedded in cultural experience.

To begin with, early test makers had to decide what to test for. The decision seemed straightforward. They wanted to test people's ability to perform the kinds of tasks that are required by schools. They observed classrooms, looked at textbooks, talked to teachers, and used their intuitions to arrive at some idea of the many different kinds of knowledge and skills that children are eventually expected to master in school.

What Binet and his colleagues found was not easy to describe briefly, as anyone who has looked into a classroom can quickly testify (and all of us have done so, or we would not be reading these words). There was a very obvious need to understand graphic symbols, such as alphabets and number systems. So recognition of these symbols was tested. But mastery of the rudiments of these symbols was not enough. Children were also expected to manipulate these symbols to store and retrieve vast amounts of information, to rearrange this information according to the demands of the moment, and to use the information to solve a great variety of problems that had never arisen before in the experience of the individual pupil. Thus, children's abilities to remember and carry out sequences of movements, to define words, to construct plausible event sequences from jumbled picture sequences, and to recognize the missing element in graphic designs were tested (along with many other components of school-based problems).

It was also obvious that to master more and more esoteric applications of the basic knowledge contained in alpha-numeric writing systems, pupils had to learn to master their own behavior. They had not only to engage in a variety of "mental activities" directed at processing information; they also had to gain control over their own attention, applying it not according to the whim of the moment, but according to the whim of the teacher and the demands of the text.

It was clearly impossible to arrive at a single sample of all the kinds of thinking required by "the" school. Not only was there too much going on in any one classroom to make this feasible; it was equally clear that the school required different abilities from children of different ages. Binet realized that estimates of "basic aptitude" for this range of material would depend upon how much the child had learned about the specific content before he or she arrived at school, but he felt knowing a child's current abilities would be useful to teachers anyway.

In the face of these difficulties, Binet decided to construct a sample of school-like tasks appropriate for each year of education, starting with the elementary grades, and reaching into higher levels of the curriculum. He would have liked to sample so that all essential activities were included in his test and that tasks at one level of difficulty would be stepping stones to tasks at the next higher level. But because no firmly based theory of higher psychological functions existed, Binet had to rely on a combination of his own common sense and a logical analysis of tasks that different classrooms seem to require (for example, you have to be able to remember three random digits before you can remember four; you have to know the alphabet before you can read). He also hit on the handy strategy of letting the children themselves tell him when an item selected for the test was appropriate. Beginning with a large set of possible test questions, Binet hunted for items that half the children at a given age level could solve. An "average" child would then be one who solved problems appropriate to his or her age level. Keeping items that discriminated between children of different ages (as well as items that seemed to sample the activities demanded of kids in their classrooms), he arrived, with help from his colleagues, at the first important prototype of the modern IQ test.

Of course a great deal of work has gone into the construction of tests since Binet's early efforts, but the underlying logic has remained pretty much the same: sample the kinds of activities demanded by the culture (in the form of the problems it requires that its children master in school) and compare children's performance to see how many of these activities they have mastered. Children who have mastered far less than we would expect given a comparable sample of kids their own age are those who will need extra help if they are to reach the level expected by the culture.

This strategy is perfectly reasonable, so long as we stay within the framework that generated the item selection procedures in the first place. However, much to the disapproval of Binet, people found new uses for these tests of school-based knowledge that carried with them the seeds of the current disputes over IQ testing. Although Binet specifically warned against the procedure, his test and tests like it began to be used as *measures* of an overall aptitude for solving problems *in general*, rather than *samples* of problem-solving ability and knowledge *in particular*. Those engaged in such extrapolations acknowledged that in principle it is important to make certain that every one given the test has an equal opportunity to learn the material that the test demands. But in practice there was no way to guarantee this essential prerequisite for making comparative judgments about basic abilities.

These are important issues in thinking about applications of IQ testing, and they are extensively discussed in the psychological literature. However, it is not until we back up and examine the possible significance of Binet's work in the light of anthropological scholarship that we can see just how limited an enterprise IQ testing was at the beginning, and how restricted it remains today.

A Thought Experiment in Test Construction

A good starting point for this reexamination is to think about what sort of activity Binet would have engaged in if he had been a member of a cultural group vastly different from his own. As a sort of "thought experiment" let us suppose that a "West African" Binet has taken an interest in the kinds of knowledge and skills that a child growing up in his part of the world would need to master as an adult. To make the thought experiment somewhat concrete, I will do my supposing about the tribal groups inhabiting the interior of Liberia, principally the Kpelle people, among whom I have worked and about whom a good deal of relevant information is available. (Bellman, 1975; Cole et al, 1971; Gibbs, 1965).

Following in the footsteps of his French model, our Liberian Binet would want to make a catalogue of the kinds of activities that children are expected to master by their parents and the village elders. People in rural Liberia make their living by growing rice and other crops, which they supplement with meat and fish when these scarce commodities can be obtained. Rice farming is physically difficult work that demands considerable knowledge and planning for its success, but as practiced by the Kpelle, it is not a technologically sophisticated enterprise. It is carried out using simple tools such as a machete to cut the underbrush; fire to burn the dry brush; vines to tie together fence posts in order to keep out animals, and slingshots to harass. (Gay, 1973). Other aspects of Kpelle material culture are also relatively simple, although in every case the proper use of tools requires a good deal of knowledge about how the tools are supposed to be used. There is division of labor among Kpelle adults (men hunt, women do most of the fishing; men cut the bush on the farms, women plant the seed, children guard the crops), but far more than is true of contemporary America, everyone pretty well knows what there is to know about adult economic activities. There are some specialists (blacksmiths, bonesetters, weavers) whose work is an exception to this generalization, and study of their activities would certainly be important.

Of course, there is more to getting through life as a Kpelle than growing rice or weaving cloth. All descriptions of the social organization of Kpelle life stress that, as in America, knowledge of the social worlds is essential to adult status. Kpelle people are linked by a complex set of relations that control how much of the resources available to the society actually get to the individual.

Faced with this situation, how should our West African Binet proceed? Should he sample all the kinds of activities valued by adults? This strategy is almost certainly unrealistic. Even allowing for the possibility that aspects of technology make it reasonable to speak of the Kpelle as a "less complex" society than our own, it is very complex indeed. No anthropologist would claim to have achieved a really thorough description of even one such society. Moreover, like Tylor, he would have to admit the possibility that in some respects Kpelle society provides members with more complex tasks than we are likely to face. Since it is unreasonable in

Liberia, as it is in the United States, to think that we can come up with a test that samples *all* types of Kpelle adult activities, why not follow Binet's example and sample an important subset of those activities? From an anthropological perspective, schools are social institutions for assuring that adult knowledge of highly valued kinds gets transmitted to a society's next generation (it must be transmitted, or there would be no later generations!) While the school is not likely to be a random sample of life's tasks, it is certainly a convenient place to sample activities that adults consider important, activities that are complex enough to make it unlikely that kids would learn what they need to know simply by "hanging around."

So, our Liberian Binet might decide to search for some institutions in his society that correspond roughly with the basic goals of schooling in ours. Not all societies readily manifest such institutions, so that anthropologists are led to speak of "socialization" as the broadest relevant category. Fortunately for discussion, in the case of Liberia, he would undoubtedly discover the existence of institutions called "bush schools" in the Creole vernacular.

There are no detailed accounts of the curriculum of the bush school. The three or four years that youngsters spend are organized by town elders who are leaders in the secret societies that control a variety of esoteric information. This material cannot, on pain of death, be communicated to outsiders. (Bellman, 1975). However, we know enough about aspects of bush school activities to continue our hypothetical research; we know that youngsters learn to farm, construct houses, track animals, shoot birds, and carry out a variety of adult economic activities (children live apart from their home villages in something like a scouting camp during their time in bush school). They are also instructed in the important lore of the group. This lore is communicated not only in a variety of ceremonies, but in stories, myths, and riddles. So, let us suppose that our West African Binet decided to use "successful execution of bush school activities" as the abilities he wanted to sample.

Again, like Binet, our researcher would not be able to sample *all* such activities for his test, nor would he want to. He would not, for example, want to sample activities that all children knew how to accomplish before they got to school, nor would he want to sample activities considered so universally accessible that everyone mastered them well before the end of schooling. This information would not help him pick out those children who needed extra instruction. Instead, he would seek those activities that discriminated among children, activities that some mastered far earlier than others, and perhaps activities that some mastered only in later life. Once these Binet-like restrictions had been placed upon the activities selected for study, our hypothetical researcher could begin selecting tasks on which he could base test items.

In considering what sort of test would emerge, it is useful first to consider what activities would be excluded as well as those included. Cutting brush or sowing rice seed probably would not be the test; everyone knows how to do that before he or she gets to school. Nor would anyone spend time explicitly teaching children common vocabulary. However, there would be explicit instruction in such tasks as constructing houses and identifying leaves that are useful in different kinds of medicine. There would also be some mechanism for insuring that the history of the group and its laws and customs were taught to everyone often in the form of stories and dances. Finally, some children would be selected for specialist roles that would require special tests (bonesetter, weaver, midwife, blacksmith, hunter, and so on). These children would receive additional instruction.

Looking at those areas where instruction might be considered important, we can see many candidate activities for testing. We might want to see if children had learned all of the important leaf names for making medicine. Riddles are often important parts of stories and arguments, so we could test to see how many riddles children know and how adept they are at interpreting them. The specialties would be a rich source of test material, especially if we thought that rational testing of ability to perform like adults would improve the quality of our cloth or machetes. In short, it seems possible, in principle, to come up with test items that could perform functions in Kpelle society similar to the way that Binet wanted to use IQ tests.

Could we carry out such a program of research *in practice*? There is no simple answer to this question, but it is useful to consider the obstacles. For some activities such as naming leaves or remembering riddles, it should be relatively easy to make the relevant observations because the Kpelle have already arranged for them: several researchers have described children's games that embody precisely these activities. (Cole et al, 1971; Lancy, 1977; Kulah, 1973). We could also test people's skills at constructing houses, weaving designs, and forging sturdy hoes. However, from a Kpelle point of view, test of such skills would not be particularly interesting. The real stuff of using one's wits to get along in the world has been excluded.

This point was made very explicitly by a sophisticated Kpelle acquaintance of mine who was versed in the more esoteric aspects of Kpelle secret societies and medicine (or magic, according to American stereotypes). We had been talking about what it means to be intelligent in Kpelle society (the most appropriate term is translated as "clever"). "Can you be a clever farmer?" I asked. "No," came the reply. "You can be a hardworking farmer, or you can be a lucky farmer, but we couldn't say that someone is a clever farmer. Everyone knows how to farm. We use 'clever' when we talk about the way someone gets other people to help him. Some people always win arguments. Some people know how to deal with strangers. Some people know powerful medicine. These are the things we talk about as clever."

In this bit of dialogue we see an emphasis on activities that require social interaction as the arena where intelligence is an appropriate concept. (Among the Kpelle and many other nontechnological groups, display of a good memory for use in discussions is often considered an important component of intelligence.) (Dube, 1977). This usage is quite consistent with Binet's analysis; it is those activities that differentiate among people in terms of the way they manipulate information that the Kpelle, like the French, use to mark intelligence.

However, once we reach this point, we face two important difficulties. First, the situations that we have selected for our study of Kpelle intelligence are exceedingly difficult to describe. Second, these contexts are very difficult to arrange. It is not enough to know riddles; everyone knows riddles. What is important about riddles is how they are used to get one's way with other people. Riddles are a resource to be used in a variety of social interactions where people's statuses and rights are at issue.

Consider the first difficulty. Bellman (1978) recounts an occasion when an elder member of a secret society told a long story about how he came to be a high ranking shaman. He followed this (presumably autobiographical) story with a long riddle, which was also in story form. A novice such as myself would have no way of figuring out what part of the story was true, and I certainly would not have responded to the riddle as if its interpretation depended upon the biographical story; the two monologues appear to be about quite different topics. Bellman succeeds in demonstrating, however, that the riddle is closely linked to the autobiography. Not only are there formal, structural similarities (once one understands the basic categories of the relevant Kpelle belief systems), there is a rhetorical link as well. The autobiographical story actually represents a bit of self-aggrandizement by the person who told it. The man is claiming special knowledge and special power in a covert manner. The riddle reinforces the main point of the story (which raises the teller above his fellow shaman), giving the story "logical" as well as "historical" validity. The fact that listeners are constrained to agree with the riddle also gets them to agree, at least in part, with the message of the autobiographical story.

By almost any account, this man's autobiographical account plus riddle is a clever bit of behavior. It is exactly the kind of thing that our West African Binet ought to be sampling. But, at precisely this point, our cross-cultural thought experiment in IQ testing comes apart. As I have already pointed out, in order to construct a test Binet needed to be able to select a large number of items. But the "item" we have just described (very loosely) is not easily constructable. The participants in this scene were doing social work on each other; the shaman, in particular, was attempting to establish his preeminence using an account of his past history that would be difficult to check up on, a riddle whose structure was designed to reinforce his account, and his knowledge of his listener's state of knowledge concerning both the shaman's past and Kpelle social structure. This was one item; it was constructed by the subject, not the "tester." It is very difficult for me to imagine how to insure that a test includes one or more items "of this type." Furthermore, because the example's structure and content depend upon the special circumstances surrounding it, how could I insure that I would be able to present the test to the subject since it was the "subject" who did a lot of the presenting in the example I have described?

Here the contrast with Binet's situation is very strong. Like Binet, we have proceeded by figuring out what sorts of activities differentiate people according to some notion of what it means to behave intelligently. Unlike Binet, the activities we need to sample in West Africa to accomplish this goal lead us into domains that are *systematically absent from Binet's tests*. These domains involve interactions among people in which flexibly employed social knowledge is of paramount importance. They are not domains of hypothetical knowledge; rather, they always involve some real operations on the world, operations that require a great deal of care simply to describe. We have no good notion of how to make such activities happen in a manner analogous to the way that teachers make vocabulary tests and multiplication problems happen. Furthermore, even if we solved all these problems, we would have no real theory of the psychological processes that our subject engaged in. Such problems have not been studied by cognitive psychologists.

On both practical and theoretical grounds, then, it appears virtually impossible to come up with a way of testing Kpelle intelligence in a manner really equivalent to what we understand to be intelligence tests in our society. So long as we restrict our attention to Kpelle culture, this conclusion should not cause much consternation. After all, the idea of a West African Binet is rather absurd; Kpelle people have managed to pass on their culture for many years without IQ tests to help them select clever children and to give extra assistance to the dull.

Some Implications for the Notion of a Culture-Free Test

Our characterization of what one has to do to be clever in Kpelle culture and what it would take to sample such cleverness in a test must be discomforting for anyone who imagines that one can construct a culture-free test of intelligence. Imagine, for example, that by some quirk it was our imaginary Liberian Binet who constructed the first IQ test, and that other West African tribal people had refined it. Next, imagine that American children were posed items from the West African test. Even items considered too simple for Kpelle eight-year-olds would cause our children severe problems. Learning the names of leaves, for example, has proven too difficult for more than one American Ph.D. (Bowen, 1964). Our children know some riddles, but little use is made of such knowledge in our society except for riddling, which would put them at a severe disadvantage on more "advanced" items.

If our children were forced to take a test constructed by a West African Binet, we might object that these Kpelle-derived items were unfairly biased toward Kpelle culture. If the eventual incomes of our children depended in any way on their ability to interpret Kpelle riddles, we would be outraged. Nor would we be too happy if their incomes depended upon their use of their own riddles as rhetorical devices. At the very minimum, we would want a *culture-free test* if real life outcomes depended upon test performance. However, what kind of test is a West African Binet likely to dream up that we would consider culture-free? It would not involve a set of drawings of geometrically precise figures, because Kpelle, a preliterate group, do not engage in much graphic representation and they have no technology for drawing straight lines. It would not be recall of lists of nonsense syllables or even lists of words, because there are no corresponding activities in Kpelle adult life. We might try a memory test like recalling all of one's family, but here the Kpelle, who teach their children genealogies, would have a distinct advantage: what is the name of your grandmother's father on your father's side of the family? In fact, if we run down the list of presumably culture-free items that our experiment on Kpelle IQ testing turned up, we would almost certainly find none of the subtests that have been claimed as culture-free tests of intelligence in our society. The reason is very simple; our West African Binet, having scientifically sampled his culture, would have come up with items that reflect valued activities and that differentiate people in *his* culture, while Binet and all his successors have come up with items that do the same job in our culture. *They are different kinds of activities*.

The only way to obtain a culture-free test is to construct items that are equally a part of the experience of all cultures. Following the logic of Binet's undertaking, this would require us to sample the valued adult activities in all cultures (or at least two!) and identify activities equivalent in their structure and frequency of occurrence.

I probably do not have to belabor this point further. The simple fact is that we know of no tests that are culture-free, only tests for which we have no good theory of how culture affects performance. Lacking such a theory, we lack any guidelines that would permit us to specify clear connections between cultural experience and performance.

Return to First Principles

Our imagined study of cross-cultural test construction makes it clear that tests of ability are inevitably cultural devices. This conclusion must seem dreary and disappointing to people who have been working to construct valid, culture-free tests. But from the perspective of history and logic, it simply confirms the fact, stated so clearly by Franz Boas half a century ago, that "mind, independent of experience, is inconceivable."

The historical experience of anthropologists has led them to consider it axiomatic that the abilities you choose to sample have to be drawn from an analysis of indigenous, culturally organized activities. Because different cultures emphasize different kinds of activities, the valued abilities will differ. From this point of view, a test that is equally valid across cultures would be a test that sampled some domain of activity that occurs in roughly the same form and same frequency in the cultures being compared. While it is possible, in principle, to identify such activities, they may not be of much use for the purposes of ability testing in the tradition of IQ tests. Many psychologists and anthropologists have asserted that some core set of experiences is common to all cultures.

Such assertions are at the heart of such major systems as those constructed by Sigmund Freud, Jean Piaget, and Abraham Kardiner, to name just a few important figures who have studied this problem. But it is simultaneously asserted that everyone, irrespective of culture, comes to master those basic activities common to our species. Piaget, whose work is most closely associated with the development of intellectual skills, explicitly assumes that there will be universal acquisition of basic understandings of the physical and social worlds because of universal constraints on behavior common to all cultures. There are no existing data to refute this assumption.

However, both our nineteenth-century anthropological forefathers and twentieth-century scholars such as Piaget readily admit cultural differences *associated with particular domains of activity.* Tylor, Spencer, and other nineteenth-century cultural evolutionists focused on differences traceable to technology. Piaget believes that special institutions and technologies of cultural transmission, such as the modern school, produce culturally determined cultural differences. So long as we restrict ourselves to specifiable domains, it is possible to rank cultures and, consequently, rank the intellectual achievements of individuals from different cultures within those domains. So, for example, we can rank cultures in the sophistication of their means of communication (from oral cultures, to literate cultures, to those possessing electronic media); we can rank cultures in terms of the complexity of dance movements that people are expected to master; we can rank cultures in terms of the degree of urbanization that characterizes the lives of their members, or the degree of rhetorical skill in institutionalized settings that they require.

Any time we engage in such domain-specific comparisons, we can expect cultural differences in the abilities that individual culture users will have developed to achieve the required level of proficiency. Americans will be expected to deal more effectively with graphic symbols than Kpelle or Balinese. But if we chose dance movements as our subject matter, the opposite ordering of culturally linked proficiencies is certain to emerge. In either case, from an anthropological perspective, we would have no illusions that our tests of ability were culture-fair. Why should we? After all, if we choose to compare people in domains where their experience differs, we expect mind to differ as well. That conclusion is certainly a basic legacy of nineteenth-century anthropology.

Sticking to this point of view provides us with a powerful way of understanding the relation between IQ testing and social demands. We can recognize the school as an institutionalized setting designed to provide children with massive practice in activities that are useful and valued in our society. IQ tests sample school activities, and therefore, indirectly, valued social activities, *in our culture*. Insofar as such tests are really used to insure that all children master the required skills, such tests would have to be considered extremely useful. However, insofar as such tests act as screening devices giving access to some people and not to others, without any commitment to insuring that all achieve the level of proficiency required fcr full participation in the adult life and access to the resources available to adults in our society, their initial purpose has been subverted and must be reexamined. This will be no easy task, since there is little current agreement on the intellectual skills needed for performing in most adult occupations.

Implications for Teaching

Teachers facing the enormous heterogeneity of classrooms in many parts of America may well be tempted to set aside this essay as essentially irrelevant to their classroom practices, whether they agree with my arguments for a culturally conditioned notion of intelligence or not. With respect to classroom organization and curriculum, what follows from the notion that children who may fumble or fail in typical classroom settings shine elsewhere? How can such knowledge be used to advantage?

Perhaps the first thing that needs emphasizing is that a child's skill in a nonclassroom setting does not imply that poor performance in the classroom is not a problem, either for the child or for the society which uses schooling as a major means of imparting valued social knowledge. The past decade of research on the cognitive consequences of schooling convincingly shows that there are systems of cognitive activity closely correlated with modern schooling that are sharply differentiated from the systems of activity that govern a wide range of activities outside the confines of school. (Sharp et al, 1979; Stevenson et al, 1978; Rogoff, 1981). When people who have not experienced schooling are tested using materials and interactional formats characteristic of schooling, they perform poorly. This is a social fact and an important social fact in the lives of the people involved.

While it is true that the activities associated with South Sea navigation (Gladwin, 1970; Lewis, 1976), Botswanian story telling (Dube, 1977) and West African fish mongering (Quinn, 1978) each represent highly articulated uses of intelligence, people who excel at these activities must still confront the fact that the domains of activity where these skills are valued are either being stamped out by the economic and political power of schooled, technological societies or they are being encapsulated within lower echelons of them. In the modern world, to be unschooled is to be denied access to the basic contexts where wealth and power are brokered. As Jerome Bruner and I noted more than a decade ago,

> cultural *deprivation* represents a special case of cultural *difference* that arises when an individual is faced with demands to perform in a manner inconsistent with his past (cultural) experience. In the present social context of the United States, the great power of the middle class has rendered differences into deficits because middle-class behavior is the yardstick of success. (Bruner & Cole, 1972).

I might phrase matters slightly differently now, but I do not think that the significance of that middle-class standard has lessened in the intervening decade. In fact, with respect to a strategy that says that schools must pay increased respect to cultural diversity, the situation has become, if anything, more rigid.

UNIFORM TREATMENT METHODS

Faced with the enormous heterogeneity of many American schools and the generally poor performance of culturally different peoples, highly structured, bottom-up strategies like the Achievement Goals Program in use in San Diego City Schools have won wide approval. These methods are closely tied to means of measuring time on task and therefore serve as a means of control to insure that all children "get the basics." They emphasize very specific, highly uniform, "correct steps" in mastering the basics. I have grave concerns about these kinds of efforts because I have had too much experience in recent years with children at the bottom 20 percent of my local school system who do not make it through the structure; they seem to do all right in the early grades, but they fail to make the essential transition from "basic" to "higher order" skills in mathematics and reading. Rather than focus on the problems of this highly uniform method of resolving the problem of cultural variation, we have been interested in our research group in ways to take advantage of diversity.

A completely different way of achieving excellence that nonetheless seems to match the urge of the "back to basics" movement and to apply a single method for all children in the classroom at one time is exemplified in demonstrations such as those of Marva Collins (1982) and Sylvia Ashton-Warner (1972). These teachers focus uncompromisingly on the highest ideas of western civilization in their teaching. They teach to whole classrooms of diversely prepared students at one time, but somehow find a way to involve each child in the excitement, despite very divergent cultural traditions separating children from curriculum. Here the teacher evokes deep involvement from every *individual* child by the exercise of a kind of empathetic skill that makes us call teaching an art, not a science.

As an art, this kind of activity is notorious for its failure to transfer. Marva Collins could not transfer it beyond a single, other teacher working with her at close range; her ideas came apart when the scale of activity was too great for her to control personally. Sylvia Ashton-Warner was not able to transfer methods developed in New Zealand among the Maori to Colorado among the privileged.

Master teachers can demonstrate to us what is possible. When the context of teaching is so arranged that the children are truly captivated, there resides a very important achievement. It provides educational science with a goal, however utopian, against which to judge its failures; why can't we make *every* classroom work?

APPROACHES EMPHASIZING DIVERSITY

Well, ordinary teachers, among whom I include myself, are not able to weave the kind of magic of a Marva Collins or a Sylvia Warner. But many ordinary teachers do not like to work in the restrictive atmosphere of an AGP school. The problem is to offer a workable, scientific alternative. That means an alternative that can approach the same heterogeneity of children's backgrounds as more "uniformitarian" strategies like AGP and succeed. It means an alternative that is transferable because it can be taught in teacher education programs and education schools. It means an alternative that does not cost more, or much more, than the money that is being expended on education now.

No such overall alternative formulation exists, but there has accumulated a set of educational demonstrations that, taken as a group, offers a different, culture-sensitive way to deal with academic diversity in the classroom. Among these culture-sensitive approaches it is possible to see several clusters.

First, there are studies like the Kamehameha Early Education Project (KEEP) (Au, 1979, 1980; Gallimore & Au, 1979) and that of Erickson and Mohatt (1980) that can establish links between particular modes of pedagogy and the nonschool organization of experience. These efforts are most appropriate in settings where there is a single distinctive cultural tradition shared by most, if not all, of the students.

The Kamehameha Early Education Project was working with Native Hawaiian children who did not succeed with structured, code-emphasis instruction in reading. As they moved into direct teaching of comprehension, they slowly evolved a lesson format that seemed to catch the children up in an active and effective way. An analysis of the successful teaching techniques revealed that the procedures they eventually developed mapped onto an indigenous cultural activity, "talk story." (Boggs, in press). The children had all been present on many occasions of talk story, but they were not old enough themselves to participate in talk story at home. So when they came to school they encountered reading as a variation on an already familiar pattern of instructional interactions.

This program has achieved some of the characteristics I attribute to a scientific alternative. Not only has the program demonstrated success in individual classrooms; it has been taught to new generations of teachers who have used it successfully in new classrooms.

However, many questions remain. Perhaps the correspondence between talk story and the successful KEEP reading procedures is an accident. Perhaps their teaching strategy is simply a good teaching strategy for *any* kids learning to read. The evidence on this question is not in yet, but preliminary results from our own research group suggest that there are elementary school populations for whom the procedure is *not* effective; further pursuit of the reasons why the KEEP program does and does not work will teach more about both reading and Hawaiian culture.

A different kind of demonstration is provided by Erickson and Mohatt (Phillips, 1972) from work among the Odawa in Canada. In this case, too, a successful educational strategy was connected to discourse modes prevalent in the children's community. The analysis, based on ethnographic techniques, was specific enough to warrant treatment-specific claims about the effect of the discourse strategy.

The phenomenon that Erickson and Mohatt addressed was the apparent passivity and silence of Native American students in regular classrooms that had been studied by Phillips. Very different modes of classroom discourse feel comfortable to Anglo and Native American children living in the southwestern United States. In particular, it was found that for Native American students

> the notion of a single individual being structurally set apart from all others, in anything other than an observer role, and yet still a part of the group organization, is one that Indian children probably encounter for the first time in school. (Phillips, 1972, p. 391).

Native American children who find themselves with an Anglo teacher encounter a single, powerful person regulating the behavior of many others. They adopt the observer role that they know to be appropriate. Like good observers, they are quiet. They also adhere to the rule that is not acceptable to single out individuals for praise or censure on a public occasion, and so they also remain silent, or experience difficulty, when singled out to provide an answer to the teacher's questions. The result is what Erickson and Mohatt call the "often reported phenomenon of the 'silent Indian child' in the classroom." Their behavior is inappropriate to the standard mode of instruction in which the teacher acts as a "switchboard operator" who allocates speaking turns, calls on individual children, and expects active participation.

Erickson and Mohatt show that it is possible to construct rules of participation in the classroom that are a functional blend of Anglo school curriculum and Native American discourse styles that make the classroom run much more smoothly. These patterns seemed to be learnable; an Anglo teacher was observed to change his participant structures over the course of the school year in the direction of the Odawa. (These examples demonstrate that culture-sensitive pedagogy can make a difference where it is possible to be explicit about cultural patterns and there is not much cultural heterogeneity in the classroom. In each case, it is important to note that culture-sensitive does *not* mean a focus on the traditional arts, foods, and folklore of a group. Instead culture-sensitive means sensitivity to "relatively subtle aspects of interactional etiquettes [that] are likely to go unrecognized by non-Indian teachers.") (Erickson & Mohatt, 1980, pp. 166-177).

CONTEXT-SENSITIVE APPROACHES

The KEEP and Native American examples are interesting precisely because they map on to identifiable cultural structures that, despite their divergence from the usual pattern of the school, are appropriate for instructional purposes. But many teachers face a situation where it is not a problem of the school's having one cultural background and the children one other. Rather, the children are from many and varied cultural backgrounds, even if they are from the same general ethnic group. In my own region, for example, there are many Hispanic children from varying countries of origins and years of residence in the U.S., black students of similar heterogeneity, Southeast Asians from several countries, Native Americans, and many more.

What can teachers do in circumstances of extreme student heterogeneity if they are neither master teachers nor cultural experts?

There is no single answer to this question, but one of the things what will be very helpful is to have as full a picture of the skills and interests of each individual child when they are not in school as possible. Another key element is to construct activity systems that are clearly structured, but where there is room for a good deal of creativity with respect to how each child interacts with the structure.

Activity-centered classrooms with a diversity of learning centers provide one excellent, structural format within which to connect child expertise and interest outside the school with the basic skills required by the school. They also allow a natural way for the classroom to connect with special educational resources in the community (science programs connected with museums such as Berkeley's Lawrence Hall of Science or Toronto's Science Museum, local experts among retired residents, unions, and industries).

Gottfried (no date) described the impact on classroom life of visits to the Lawrence Hall of Science, which has an outstanding set of activities for the public. Gottfried studied the way that the visit to Lawrence Hall was taken up in classroom activity. When he spent time in their classrooms with an exhibit that required considerable interaction with various animal species and insects, he found that the materials evoked different patterns of expertise among the participants.

One boy, who was doing poorly in school and of whom the teacher had a rather dim opinion, turned out to be unafraid of crayfish. That alone won him unaccustomed social credits. But it also turned out that he knew more about crayfish than the teacher and more than was provided by the encyclopedia. It turned out he was an *expert* on crayfish. Other children displayed similar kinds of virtuosity, enriching the number of interesting things to be written and worried about. As a result, the teacher learned a lot about the children, and the children displayed prowess that they would not have been known to possess if Gottfried had not disturbed the usual social order. A great deal of basic skills training resulted from the episodes.

No single such activity will captivate everyone, but everyone has some activity than can capture them. The trick is to figure out how to organize experiences out of school and variety in the classroom that will serve as the essential starting point for successful instruction. An activity-centered classroom has the great virtue of allowing parallel activity structures that are only loosely coordinated in time and space. This permits teachers to apply a variety of approaches to a particular area of academic concern, embedding reading (for example) in many contexts. Specific activity structures facilitate connections between the classroom and the outside world, enabling teachers to create occasions for transfer of home-based knowledge into school-based contexts for basic skills.

In our own research we have pursued the special power of computers to create educationally useful activity systems. (Laboratory of Comparative Human Cognition, 1982; Levin & Souviney, 1983). We have sought to create carefully scripted activity which embeds exercise in the basic skills in ways designed to maximize transfer. Thus, instead of content that replicates the format of pages of printed text, we seek to embed literacy and numeracy activities in activity structures which have some larger goal and are often gamelike in their structure. Viewing the computer as a medium for interaction rather than a surrogate teacher leads us to arrange it so that more than one person is usually working at a single console at any one time and that the entire set of operations has a clear socially accepted goal.

In other work on reading we create activity structures that are *group* enterprises, organized around a script with teachers, college students, and children mixed together with respect to roles and expertise. (Griffin et al, in press). Even children with long histories of educational failure can be caught up in these systems enabling a keener insight into their difficulties and a better chance at remediation.

CULTURE AND CONTEXT SPECIFICITY

I know of one educational innovation that combines aspects of both types of systems described above. Like the context-specific activity centers, it arranges for education to occur in contexts that can recruit children's out-of-school accomplishments so that both the children and the teacher can succeed at a school task. Like the work in Hawaii and with the Odawa, this case uses cultural understandings that all of the children have in common outside of the classroom and that are not usually used inside the classroom.

Moll and Diaz (1984) worked with Hispanic children who had fairly good literacy skills in Spanish, but were failing to learn how to read in English in spite of organized bilingual instruction. When English was being taught in the classroom, the children could not rely on their Spanish skills. The instruction was organized so that a teacher who spoke only English taught them English reading. They worked with a Spanish teacher for other parts of the day, including times when they worked on reading in Spanish at quite a high level—not only complicated comprehension work but even book reports. Yet, when they went to the English class they were faced with what looked like first grade work. The instructional program was arranged so that until the children could do fairly well in oral English, they would be kept at a beginner level in reading. These children did quite poorly. They did not advance.

The teachers were surprised to see videotapes of the children reading in the two settings: it was hard to believe that children who were so competent at reading in one language were so incompetent at learning to read in another language. No one was happy with this situation.

Moll and Diaz created an intervention that was later picked up by a "real teacher" who had the necessary attributes: she was bilingual, biliterate, and could teach reading. Moll and Diaz had discovered a way to move the children into English reading, and at an advanced grade level. They gave the children English books to read—the very same fourth grade books that their classmates were reading. The children read the English text, getting a bit of casual help from the teacher, if they asked for any, using either Spanish or English as the medium of communication. Because the teacher and the children could both use Spanish, sometime the questions and answers were in Spanish. When the children had finished a first reading of the text, the group conversation turned to what it meant. Again, the conversation was in Spanish or in English, whatever seemed most helpful. The children understood the story very well; the problems they had in comprehension were on the same sorts of text and questions that their monolingual English classmates had trouble with.

The children were, very suddenly, reading English at grade level. Granted, in English they could not display their ability as easily. But reading English they were. An "extra" ability of theirs had been the ability to speak Spanish—and they used this ability from home to *read* English. The interesting punch line to this case is that the children changed in another way: once they were allowed to use Spanish to do English reading lessons, they started to use a lot more English. Their lack of ability in speaking English had kept them from reading English in the ordinary instructional program; ironically, Moll and Diaz created a way to "get around" the first problem, only to end up finding an indirect way to solve it!

Final Comments

In the decades ahead, we can be certain that the issue of student heterogeneity in our schools is going to be important, even if no one has anything particularly useful to say about it. We do not have to subscribe to the pseudo-scientific aspects of Huxley's *Brave*

New World to realize that increased requirements for technical expertise are likely, even when combined with increased technical assistance for gaining expertise, to create a situation where the intellectually rich get richer. There is also no serious doubt that one could use any of several commercially available culture-fair tests and come up with a statistically significant prediction of who is most likely to become a highly educated, technologically successful, person.

One-sided notions of culture-free testing covertly create a uniform, quantifiable, notion of what intelligence *is*. Although as yet not particularly strong as a scientific and pedagogical tool, a culture-sensitive approach to testing and intelligence seems to provide guidance in the creation of mixed systems of education that will take advantage of the heterogeneity instead of suppressing it. Context-sensitive approaches appear to be especially helpful in dealing with situations of extreme diversity, because they allow the kinds of flexibility that can organize a variety of resources to assist children in benefiting from their educational experiences; they can be shown to work. However, they remain enough of an "art" so that transfer and generalization are still very problematic in many cases. Very often they remain no more than demonstrations, with no scientific framework or bureaucratic structure to engineer their uptake in the educational system.

A decade from now, when the next time rolls around for the National Society for the Study of Education to be thinking of yearbook articles on this topic, it will be interesting to see if the currently successful brands of context- and culture-specific science and pedagogy will have been able to survive, not to say prosper, in a world people are currently fond of calling the "coming information age."

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Resumen. Unos psicólogos han creado 'cultura-libre pruebas' para proveer una medida

sin prejuicios de habilidad individual por probar de universales en la experencia humana. El autor trabaja con una investigación mental para argüir que la inteligencia sin referencia a cultura es una contradicción en términos, y presenta unos casos para no dejar de que una maestra culturalmente sensible es un ingrediente imprescindible de la enseñanza de éxito con alumnos culturalmente diversos.

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The Social Worlds of Children: An Emic View[*]

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Abstract. In this paper we want to describe a research study we are conducting with the goal of understanding the social world of children. By coupling the theoretical ideas of Daniil Borisovich El'konin on the socio-historical nature of childhood (El'konin, 1980; Venger, Slobodchikov & El'konin, 1990) with a case study of one particular child's life, in and out of school, our intent is twofold. First, we wish to elucidate the theoretical importance of studying children's social lives; and second, we will illustrate the sorts of insights one gains about children by obtaining their perspectives and social

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understandings (for a review of literature, see Andrade, 1992).

* * * * *

We begin with a selective and necessarily brief discussion of El'konin's work. The key notion of El'konin that we want to address is that children form a community, a social world, that is *separate* from that of adults, but that at the same time *mediates* the relations between adults (and their social institutions) and other children. We take this idea to have important theoretical and practical consequences for our work in education, especially as it underlies the necessity of understanding emically, from their view, how children create and develop their social worlds and understandings, and the resulting relationships with the adult world. We then present examples from our case study to illustrate our methods, given our theoretical views, and some findings that provide revealing glimpses of aspects of children's social worlds that are usually hidden from adult investigators. We close with a discussion of implications for education and research.

The definition of "emic" which is ascribed to in this article, is one which seeks to retain the originality of the speaker. We use the term "emic" to refer to a qualitative approach in which the researcher observes, interviews, and records; seeking to capture and understand the reality and perspective of the "informants." The essence of our use of the term is to capture the children's perspectives, multiple voices, and their understandings of their worlds, including among them the classroom world.

El'konin's theoretical views

Venger et al. (1990) have extricated from El'konin's scientific work his general approach to problems of child psychology. El'konin's contribution, as does Vygotsky's (1978), lies in understanding the great significance of the social and historical essence of childhood; the understanding that not only the concept of childhood, but children's activities themselves, such as play, activity with objects, relationships with people, and schooling are "societal in origin, content, and form" (Venger et al., 1990, p. 29; also see El'konin, 1980, Ch. 2). This point is particularly significant in light of the many assumptions of what constitutes "natural" behavior in children. For example, consider the popular and well-accepted characterization that adolescents are "rebellious by nature" as a stage in their development. As Valsiner (1989) has pointed out, in examining cross-culturally the concept of adolescence, the characterization of this age group as problematic and rebellious is a culture-specific, adult invention, not a general attribute of adolescence. In fact, this idea of "the inherent rebelliousness of adolescents is a rather recent invention in the history of the Western world" dating to the beginning of the century (p. 336). This characterization of rebelliousness as a "natural" trait, is one of many "adult-centric" (and culturally-bound) views of children that easily turn into stereotypes about the "nature" of one group or the other (Allport, 1954; van Dijk, 1987). We will address this point further in our examples below.

It would also serve us well to keep in mind that schools, as settings separated and distinct from everyday contexts of learning, are themselves a relatively recent cultural invention, as is the now standard or "natural" practice of age segregation. This practice, among other regimentations, has also contributed to the formation of children's social worlds that are independent from those of adults, a point which we address shortly.

El'konin also insisted on what Venger et al. (1990) call the "non-adaptiveness" of children. By non-adaptiveness, we understand El'konin to say that children do not merely adapt to existing social structures, or are "socialized" by others into adult roles. In fact, El'konin objected to the term "socialization," which implies the fitting or training of children *for* a social environment (Venger et al., 1990, p. 25). Instead, El'konin argued for the importance of taking a "constructive" view of the child, wherein the child is an active agent in forming her attitudes and relationships towards others, as well as influencing those of others towards her. The child's life then, is a process of ever-changing roles and ongoing development afforded by the experiences of the child with (cultural) environments and the individuals comprising those environments. Children actively create or co-construct their social worlds, and by consequence, themselves, through their own actions. Of course, this theme of the active and creative role of human beings is central to the socio-historical school of psychology, especially in Vygotsky's works, as Valsiner (1988) has indicated,

> the developing child is constantly in the process of constructing his own future development--sometimes by his own means (in play) and at other times with explicit assistance from others (under instruction). However, even when the child constructs his own development in play, the environment within which the play takes place is prestructured culturally. In this sense, all child development is necessarily cultural in its nature--culture is constructed by the child within the limits specified by the child's 'social others.' (p. 149)

Another category in El'konin's theory is concerned with the issue of crisis. For example, distinctions are made between age-related crises (critical ages) and historical childhood crises, which are brought upon by historical developments affecting childhood, i.e. inventions, labor, schooling. The work of Nassaw (1985), Postman (1982), and Zelizer (1985) address such historical periods of crises and their effects upon childhood as a social construction.

Postman (1982), for example, states that "unlike infancy, childhood is a social artifact, not a biological category," further, the use of the word childhood as it has been understood by the "average American," is not more than one hundred and fifty years old (p. xi). Postman adds that,

> we must not confuse, at the outset, social facts with social ideas. The idea of childhood is one of the great inventions of the Renaissance. Perhaps its most humane one. Along with science, the nation-state, and religious freedom, childhood as both a social structure and a psychological condition emerged around the sixteenth century and has been refined and nourished into our own times. (p. xii)

In discussing historically the concept of childhood, we can begin to understand its shifting nature and interpretation. Interestingly, Postman (1982) relates the changing perceptions of childhood to the development of literacy. He explains that in the medieval world, neither the young nor the old could read, and their concerns were of the day, no more, no less. Further, he writes,

> that is why there had been no need for the ideas of childhood, for everyone shared the same information environment and therefore lived in the same social and intellectual world....From print [invention of the printing press] onward, adulthood had to be earned. It became a *symbolic* [italics added], not a biological, achievement. (p. 36)

Adulthood, in other words, was earned in great part through the acquisition of literacy. Postman's argument is concerned with linking the development of childhood to the acquisition of literacy, and as such does make an important contribution to the growing body of knowledge concerned with understanding the social constructions of the child and the concepts of childhood. But in and of itself, Postman's work does not and cannot provide a sole explanation for the development of childhood.

During the mid-nineteenth century, childhood was work. Within the course of their workday, children squeezed in school and play. Children were valued for contributing economically or domestically, or both, to the family unit. Those children having formal employment in factories or doing 'piece' work at home, customarily delivered their paychecks to their parents. Some of these children received an 'allowance' of sorts. Others who worked at selling newspapers, candy, or other items; 'blackening' shoes; sewing; scavenging for metal, food, etc., would generally turn their money in at the day's end, keeping a few cents for candy, gum, movies, or clothing; further evidence that these children were consumers as well. Also characteristic of children of that time, was the adoption of other adult customs, i.e. smoking, and adult vestment. The picture created of children of that time is, in so many ways, that of a small adult; dressing, smoking, working to support the family, and consuming goods much like the adult of that era (see Nassaw, 1985, for not only a historical recount of children's lives during the first two decades of this century, but also the visual narration which the photographs provide).

Children were in a sense a productive, yet cheap workforce. That is, until child labor opponents became involved, decrying the exploitation of the nation's children, their health and their lives. With this movement, and subsequent laws, came a societal change in the general attitude towards children. This change proved to be the economic devaluation of the child. The child was no longer productive, and therefore no longer of value economically speaking. But the "new child" was valuable emotionally, and that value was in Zelizer's (1985) terms, "priceless." The child, once a source of economic support, was now a source of pleasure to the family. The family, and later the school, was now to be entrusted to the care and nurturance of the child. This was of course not an overnight, nor all encompassing, change, but a gradual one (see the work of Nassaw, 1985; and Zelizer, 1985, for indepth discussion and documentation of these phenomena). These changes, in turn, influenced the social constructions of childhood, for there has not been one uniform childhood, but various forms of childhood, what Venger et al. (1990) term a "historical series of ontogenies" (p. 27)

According to El'konin in Venger et al. (1990), the methodological means by which a child's world view can be studied, is "by means of the activity through which an *integral conception* [italics added] of the object, in this case childhood, is constructed" (p. 27). El'konin's work suggests that childhood needs to be studied dynamically and always in relation to social and historical specifics. He advocated what we would call a "holistic" approach.

In our study, we are trying to develop this "integral conception" through a series of case studies that capture the children's activities and thinking in both classroom and community settings. In a departure from traditional methods of study that advocate "objectivity" by distancing the researcher from those studied, we have developed an approach that facilitates the development of prolonged, peer-like relationships with the children. The relation is one of continuous reciprocity. This "researcher as peer" role is not necessarily the same as the relationship of children with like-age peers, but is similar in other respects, particularly in the development of a long-term friendship based on mutual trust and visitations. It is through the exchanges of knowledge and information that this relationship fosters, that we obtain "data" on the children's social worlds, including their concerns and opinions. In what follows we elaborate on this method of study and then present case examples from one of the children in our sample, Susana, a child we have been interacting with for three years and who has become a key "collaborator" in our research efforts.

Gaining entry into children's social worlds. Our study is patterned after earlier work which analyzed households, classrooms, and after-school settings to advance our understanding of home and school dynamics (see Moll, 1992). Our work involved participant observations, collecting writing samples, conducting interviews and administering questionnaires. The value of this work notwithstanding, we felt that the general approach overlooked the active participation and constructiveness of children in the home, school, community, and in their own social networks. Subsequently, we began to search for and develop a methodology which would enable us to study the social worlds of the child, as well as adopt a theoretical stance which would allow for this point of view. We developed a novel methodology that would allow the researcher to interact more frequently and fruitfully in children's lives, a methodology that would allow for the active inclusion of the child and her social world. As a consequence of our endeavors, we gained intimate glimpses into children's social worlds, thus confirming our philosophical approach to understanding children's lives as they themselves live them, which is quite faithful to the theoretical stance of El'konin. In what follows, we discuss our experiences.

Methodology. We are combining observations and interviews with interactive dialogue journals to obtain children's perspectives on themselves and their social worlds.

The dialogue journal is an ongoing, private conversation between the child and the researcher, with the distinction that the conversation takes on a written form. The dialogue journal itself adheres to four central themes, as originally outlined by Staton (1988). Those themes are: 1) the development of a mutual understanding among the participants (mutuality), 2) the value of functional contexts for writing, 3) the cognitive demands of the dialogue on students' thinking (constructiveness), and 4) the way in which the dialogue personalizes education (new forms of relations). Within the dialogue, the interaction is in its various aspects controlled by the child. The dialogue journals are further complemented by conversations with the children (individually, as well as in groups) and participant observations of the children within and outside the classroom, in the community, and in the home.

The type of dialogue journal maintained with these children, we believe, goes considerably beyond current applications. Staton and Kreeft Peyton's (1988) use of the dialogue journal has focused prominently on promoting writing as authentic, whereas, we have ceded that and utilized that very aspect for purposes of including children as active participants in the research. Further, we have taken the four central themes of the dialogue journal to task. Not only are they components of the dialogue journal, but they sustain the dialogue itself. That is, each dialogue is true to those themes, and therefore indicative of the correspondent child. The dialogue of the children in this study is not only authentic writing, but also an authentic representation of the children themselves, as each child represents herself, her feelings, experiences, beliefs and knowledge.

In reading and responding to journal entries, respecting the privacy of the interactants and their respective journals is foremost. Confidentiality from fellow students, as well as from the classroom teacher is crucial. The researcher's (Rosi Andrade) responses are a continuation of each child's previous entry. For example, she could question and follow specific interests that she had, but this was only possible if the child permitted it, i.e. whether the child chose to follow her line of questioning or change the subject altogether. Each child, during the course of the research, was in control of her dialogue (Fine & Sandstrom, 1988). In essence the dialogue journal was presented as a forum in which the children could openly discuss any topic. For the children, the journal became a vehicle by which to define their actions and their surroundings, this was tantamount to establishing the true dialogic nature of the interaction.

Because the children found in the researcher someone who was truly interested in understanding them on their terms and not interested in imposing her morals and values (Fine & Sandstrom, 1988), nor playing the role of disciplinarian, a sincere relationship was formed between the children and the researcher. The researcher presented herself to the children as someone who had feelings and beliefs, which could be brought to the fore when children inquired of them, e.g., during peer mediation, but her feelings and beliefs were not as important as the children's. The children's reaction was to actively seek out the researcher, by joining her during their lunch hour, inviting her to school functions or to participate in classroom activities, as well as maintaining written dialogues. Additionally, children extended invitations to their homes, some wrote letters to the researcher during the school year, whereas others maintained correspondence with her during their summer vacations, and still others made it a practice to periodically call her at home.

The theoretical implications of our approach were many, among them, as we alluded to earlier, we learned that we had indeed previously been misled by our adult perceptions, as to who children were and what their lives were like. We found that children were active participants in their own lives, working out their identities and mediating relationships with others. The concept of socialization became somewhat meaningless, in the course of our interactions with children. We found that often, adult socializing practices have little relevance to children's lives. And, we found children that are continuously changing, growing, learning, etc. The child we knew yesterday, is not necessarily the child we have before us today. Not surprisingly, these are points that are consistent with El'konin's view, as characterized earlier.

We begin by introducing Susana, who is not only the focus of this paper, but also a guiding force in our understanding and gaining entry into the social worlds of children. Along with describing Susana to the reader, we will briefly describe her family and community, and share some of her experiences and beliefs, as she has shared them with us. We have selected one specific conversation with Susana, as the focus of this paper, because it is not only indicative of our conversations in general. But also because in it, it is Susana who in great part is analyzing a fragment (discipline) of her peer's and her life during the latter years of elementary school.

Towards an integral conception of Susana

Susana is Mexican, born in Magdalena de Kino, Sonora, México. Magdalena de Kino is 110 miles north of Hermosillo, and 50 miles south of Nogales, and it is a relatively small town. Its economy relies on cattle and agricultural crops such as wheat, fruit and chickpeas. The town is also the burial place of Father Eusebio Franciso Kino, who came to the area in the late 1690's. Magdalena de Kino is a few hours driving distance from Tucson, Arizona, and it is not an uncommon trip for Susana and her family to make, especially during holidays and summer vacations. Susana is thirteen years old, and has lived in

South Tucson since the age of seven. Susana is the oldest of three children. She has a twelve year old sister, and a seven year old brother. Susana is Spanish/English bilingual, yet she is very firm in regards to the language she speaks, and when she will speak it. In this regard, Susana has written,

> Yo si seguire con el español porque es mi idioma y nadie me [puede] hacer que hable otro idioma. Yo voy a hablar otro idioma cuando me de mi gana. Perdoname pero es cierto a ti no te digo eso porque eres adulto. [I will continue with the Spanish because it is my language and nobody can make me speak another language. I will speak another language when I feel like it. Forgive me but it is true I don't tell you that because you are an adult.] (5/17/90)

Susana has been living in South Tucson since 1986. Her father, though, lived and worked in Tucson long before 1986, at which time he brought his family to live in South Tucson. Home for Susana and her family consists of a small, outdated trailer which they rent for $100 a month. The home is modestly furnished and clean by any standard. The trailer itself, sits behind another rental house, thus dividing the property into two residences. Susana's father works as a gardener for the University of Arizona, and her mother is a homemaker who also does daycare and ironing out of the home, and occasionally helps her husband on weekend gardening jobs. Susana is bilingual, but prefers to speak Spanish; her mother is Spanish monolingual; her father is learning English, but at home he speaks Spanish exclusively; her sister Chelo is bilingual, but prefers to speak English; and her brother Luis began learning English in 1st grade last year.

The city where Susana lives, South Tucson, is a predominantly Mexican, Mexican-American community. It is a 1.2 square mile city within the city of Tucson, incorporated in 1938. The 1990 Census of the United States, documents the population of South Tucson to be 5,093, and the 'Hispanic' origin population to be 83.3% of that figure. This number though may not be correct, it seems smaller than the actual population, as the Director of Planning and Zoning explains,

> When the census numerators came, they were afraid to go away from the 6th Avenue area [the main thoroughfare]. This was due to perceptions of South Tucson as high crime rate. The 1989 -1990 crime rate has decreased. (Interview, 1/17/92)

Further, the fact that in South Tucson there is a large concentration of undocumented alien Mexican citizens who fear deportation, would logically diminish the census data collected.

South Tucson has gone the route of many inner cities in the last few decades, the original luster of the city is long gone and has been tarnished by the economic and social depression of its dwellers. For example, amenities often taken for granted by other communities in the United States, such as clean and well stocked grocery stores, manicured parks, and flourishing businesses, have been long absent from this community. Restaurants and bars do prevail and flourish in the community, though, but they serve mainly as a tourist's haven for authentic Mexican food and a getaway from the Tucson community. While these restaurants sit at the edge of the city, they are ironically but a stone's throw from the local bar strip and bordered by abandoned homes and businesses frequently used as drug houses and makeshift homes for homeless boys and men.

The elementary school which Susana has attended, was built in 1923, fifteen years before the actual incorporation of South Tucson. Like South Tucson's other elementary school, it is run by the Tucson Unified School District. At the time of South Tucson's incorporation, though, the goal was to maintain autonomy. Mexican culture and the Spanish language were part and parcel of that self-contained body. And South Tucson, moved towards that goal by nominating its own mayor and city council, appointing its own police chief, and hiring its own police force and firefighters, and running its own sanitation department, and jail compound. Yet when it came to the education of its children, South Tucson became like many well meaning parents, it stepped back and left the instruction of its children to the experts.

In a community which valued its Mexican heritage and Spanish language, formal education was a cruel and humbling experience, as we shall explain. In great part due to the sociopolitical climate in the United States, towards minorities and their native languages, many Mexican and Mexican-American children suffered the brunt of our society's dislike of, or distrust towards their language and culture. In South Tucson, for example, Spanish speaking children entering school during the decades of the 30s, 40s, 50s and 60s, were not allowed to speak Spanish. They were penalized if they were caught speaking Spanish, i.e. corporal punishment, ridicule. Those children speaking Spanish or speaking English with an accent were considered slow learners or worse yet, mentally retarded. One adult, now in his mid-fifties, explains,

> They would flunk everyone in the second grade, and say that we were slow. They would send us to another [elementary school], to the Special Room. But at that school, they would say there was nothing wrong with us and send us back. We didn't know any better. We had never experienced or seen anything out of South Tucson. We thought that was the way it was. Not until I joined the army, did I understand what was going on. Our parents trusted the schools. They weren't going to argue with them. (Villegas, Summer, 1991)

We present excerpts from discussions one of the authors (Rosi Andrade) has had with Susana. For the sake of brevity, we will only report on three themes of study, Susana's perception of discrimination against her own ethnic group, her opinions about classroom discipline, and her view on conversations and meetings as "play." These issues are rarely discussed in the education literature, especially from the children's perspective, but they contribute a revealing look at one child's world.

Having shared snippets of Susana's life and the historical context that envelopes it, we move on to a recent discussion with Susana. On August 5, 1992, "I was visiting Susana at her home in South Tucson, Arizona," writes Rosi,

> We had decided to meet that afternoon to talk about some of Susana's concerns and interests. When Susana and I meet, we do so with her approval and the approval of her parents. We meet either at her home or mine, and the visits are very much like those of family friends. The visits are formal, in that they always begin with greetings and a chat with the family, i.e. parents and siblings. And then continue with Susana, generally in and around the home, or at my home. When we do not visit, Susana and I speak on the phone on a weekly basis, and write to each other in a dialogue journal and in letters. Occasionally, we go shopping, to the zoo, or to eat. We are generally accompanied by Susana's siblings and my fourteen year old brother. Chelo and Luis, Susana's siblings, don't accompany us because they have to, but because they want to, as does my brother, Antoni. This is a rather congenial group where sibling rivalries are left out, i.e. at home, Chelo often competes with Susana, and this causes friction between the two. Our relationship is not coincidental, it has been established over time, Susana and I have known each other for well over four years. (Andrade, 8/5/92)

When Susana and Rosi meet, they talk about what Susana has been doing; what has been happening in her, and her family's lives; and anything that she feels an interest in discussing. On this occasion, Susana had voiced particular interest in discussing the criminal justice system and chose to make that the topic of the conversation. During the course of Susana's discussion, the scope of the conversation continued much the same, but the focus changed. Instead of talking about crimes, jails and corruption in society, Susana talked about her classmates at the elementary school.

Susana's view of classroom life. The discussion, in fact, became a description of the interactions of children and teachers who had formed the classroom bodies during the latter years of elementary school. Within the discussion, Susana pointed to 'good' teachers she had had, and students who were not so good. Susana pointed to Mrs. C., or Mrs. Cilantro [Mrs. Coriander] as the children would mockingly call her behind her back, as an example of a good teacher. The following conversation took place in the presence of an English monolingual neighbor; it began in English, but suddenly switched to Spanish.

Susana: She's [Mrs. C.] strict, but she's good, she never screams at me, she only screams at the kids who misbehave.

Rosi: Doesn't the screaming bother you? Whenever I come to the school I can hear her.

Susana: Not really, she takes them into the hallway and screams at them there. In the classroom she pounds a rock. She only screams because they misbehave.

Rosi: But what comes first, the screaming or the misbehaving? What if she screamed at you? Would that bother you?

Susana: [Pause] No me gusta que me maltraten. [I don't like being mistreated.] (8/5/92)

As we see above, when asked what qualities good teachers had, Susana points to their strictness. Susana also presented as examples the strictness of teachers in México, and how they would rap a student's knuckles with a ruler, put them in a closet, and make students write pages upon pages of the same sentence. Yet when placed as the receiver of that strict disciplinary action, Susana's reasoning was not so straightforward. Like her parents and many adults, Susana had accepted harsh disciplinary measures as necessary for the maintenance of order and discipline. Yet when Susana became the hypothetical recipient, it troubled her. The remainder of the conversation served to confirm this point.

What we find from discussions like this, with Susana and other children, is that children don't mind strictness if it is evenhanded and if they are not denied respect (respeto).* Evenhandedness, though, would require impartiality, but impartiality is difficult to imagine if one person alone determines it. Further, the issue of respect is ever present in children's dealings (see Andrade & Moll, 1990, for a discussion of this issue).

Susana outlined six common classroom punishments and her opinion of them. Note that though Susana has not been subject to any of these punishments, she is able to relate to them, based upon her classmates' experiences.

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* Respeto is a Spanish concept not easily translated to the English word respect. It embodies not only high regard for an individual, but reverence and veneration as well.

Castigos de la escuela [School Punishments]

1. Estar parado en la esquina. [Stand in the corner] "No se logra nada, vuelven a hacer lo mismo." [Nothing is gained, they do the same thing all over again.]

2. Te gritan, te regañan. [They scream at you, they scold you] "Hay unos que aprenden. Yo no mucho. Deberían decirte una vez, calmados. Si lo dices y dices, ya no te hacen caso." [There are some that learn. Me, not very much. They should tell you once, calmly. If you say it and say it, no one listens to you.]

3. Te mandan a la oficina. [They send you to the office] "Tampoco porque nada más te dan una regañada." [Neither because they only scold you.]

4. Te suspenden. [They suspend you] "Es peor, para que no vayas a la escuela. Deberían ponerte a limpiar la escuela para que aprendas a respetar." [That's worse, so that you don't go to school. They should make you clean the school, so that you learn to respect.]

5. Te quitan privilegios. [They take privileges away from you] "No jugar o platicar con tus amigos." [No playing or talking with with your friends.]

6. Pegan. [Spanking] "Con pegando, no ayuda." [Spanking doesn't help] (Susana, 8/5/92)

These are common punishments delved out by the school, yet, according to Susana, they are ineffective. They are ineffective because they do not concern themselves with the reactions and attitudes of children. The fact that they are ineffective, points to another issue raised by Susana. Within the classroom, for example, children may break the rules or disrupt the classroom because they are upset or unhappy. To apply the above punishments is irrelevant, since they do not take into consideration the cause or nature of the friction. What form of complaints do children make of the classroom and teacher? Susana tells us,

Susana: Como Mr. M. - hay veces que está bien que esten bromeando, pero que se pasen y que a los estudiantes les moleste...[Like Mr. M. - there are times that it's okay to be kidding around, but when they overstep themselves and it bothers the students...]

Rosi: ¿por ejemplo? [for example?]

Susana: ¿Recuerdas a Ricardo y Juan David? Se burlaba de ellos, de donde vivían. Porque eran pobres. Ellos no tienen la culpa. Decía que vivían en un basurero. Ricardo me platicaba que se sentían mal ellos, pero que no le contestaban porque lo respetaban. [Do you remember Ricardo and Juan David? He used to make fun of them, where they lived. Because they were poor. It's not their fault. He would say that they lived in a dump. Ricardo would tell me that they would feel badly, but that they wouldn't talk back to him because they respected him.]

Rosi: Recuerdo que el maestro se burlaba del peinado de Ricardo, le decía algo como 'Mr. Hollywood,' y que Ricardo lo tenía algo largo y grasiento. [I recall that the teacher made fun of Ricardo's hair, he would call him something like "Mr. Hollywood,' and that Ricardo's hair was a little long and oily.]

As Andrade recalls, in the classroom, Ricardo would laugh along with the teacher and children, when the teacher made his remarks. But Juan David, would get angry and refuse to do his work.

> Susana: Mr. M. y yo nos llevábamos muy bien, se portaba bien conmigo. Pero una vez me dijo algo, no sé que fue, pero dijo algo de mi amá y apá. ¡Ay! Le podía haber dado un empujón y darle, estrellarle contra algo. Víctor me detuvo. Es la única vez que me ofendió. No le hablé por mucho tiempo. El sabía que estaba yo disgustada, pero no sabía porque. [Mr. M. and I used to get along very well, he behaved nicely towards me. But one time he said something, I don't know what it was, but he said something about my mother and father. Oh! I could have shoved and hit him, broken him into pieces against something. Víctor held me back. That was the only time he offended me. I didn't talk to him for a long time, he knew I was upset, but he didn't know why.]

Susana is neither a violent, nor angry child; she is frustrated, though, with the treatment children and minorities are subject to; she finds it difficult to inure a lack of common respect or inequality.

Susana's view of discrimination. It was, for example, during the course of Susana's 5th grade dialogue writing that she began to share increasingly more of her views and opinions in that respect. The following are excerpts from that journal. In them, we will find that Susana details what she perceives as the oppression of minority groups (Mexicanos) in the U.S. by the dominant group (gringos). In her writing there is controlled resentment against this form of social injustice. At the time of these writings, Susana was 10 years old.

Rosi: A tus padres ¿les gusta Tucson? [Do your parents like Tucson?] (5/14/90)

Susana: Se me hace que si les gusta Tucson. A mi no me gusta Tucson. Porque los gringos se creen mucho y a los mexicanos los trantan [sic] como animales. Los gringos se creen los reyes de todos los mexicanos y no sé porque mi familia se quiso venir a los Estados Unidos. [I think they like Tucson. I don't like Tucson. Because the gringos are self important and they treat Mexicans like animals. The gringos think they reign over all the Mexicans.] (5/17/90)

Rosi: ¿Porqué opinas que los gringos se creen mucho? [Why do you think the gringos are self important?] (5/25/90)

Susana: Porque se burlan de los mexicanos. Les dicen que son mojados ilegales y muchas cosas mas. Algunas personas no son tan deste para faltarte al respeto. [Because they mock the Mexicans. They call them illegal wetbacks and many other things. Some people aren't so to be disrespectful to you.] (5/25/90)

Rosi: ¿Cuál es el significado de gringo? ¿Quién es gringo? ¿Se hacen o nacen gringos? [What is the meaning of gringo? Who is a gringo? Are they born or do they become gringos?] (5/25/90)

Susana: Gringos significa las familias que nacieron aquí en los Estados Unidos. Unos que viven en los Estados Unidos. Nacen aquí en los Estados Unidos. Algunos se hacen gringos. [Gringos means the families that are born here in the United States. Some that live in the United States. They are born here in the United States. Some become gringos.] (5/25/90)

Rosi: ¿Creés tú que todos los gringos son iguales? ¿Creés que en el resto de los Estados Unidos se encuentra la misma escena que en Tucson? [Do you believe that all gringos are alike? Do you believe that the same situation is found in the rest of the United States?] (5/25/90)

Susana: No, algunos/as gringos/as son honestos no como unos son unos desgraciados. Perdóname por mi lenguaje pero lo que te digo es cierto. No sé Rosi. Me supongo que sí. [No some gringos are honest not like some that are wretched. Forgive me for my language but what I am telling you is true. I don't know Rosi. I suppose that does.] (5/25/90)

Rosi: ¿Cómo te sientes siendo mexicana en Tucson, sabiendo como son los gringos? [How do you feel, being Mexican in Tucson, knowing how the gringos are?] (5/25/90)

Susana: Yo no me siento agusto estar aquí con los gringos y no estar con mi gente de allá de México. Me quisiera ir a México con mi propia gente. [I don't feel comfortable being here with the gringos and not with my people from over there in México. I would like to go to México with my own people.] (5/25/90)

Rosi: ¿Creés que cuando seas más mayor, volverás a México? [Do you believe that when you are older, you will return to Mexico?] (5/25/90)

Susana: Sí yo volveré para mi tierra yo no estoy agusto en tierras ajenas como por ejemplo Los Estados Unidos. Yo donde estoy agusto es en mi linda tierra de México. Y todo el tiempo no más me sentiré agusto en mi tierra de México. [Yes, I will return to my land; I am not comfortable in foreign lands like for example the United States. Where I am comfortable is in my beautiful land of Mexico. And I will always only feel comfortable in my land of Mexico.] (5/25/90)

Susana has pointed to what she sees as the oppression of minority groups, in this case Mexicans; she elaborates on the term gringos, aware of the possibility of overgeneralization and stereotyping; she states that naturally, not all gringos are the same, some are honest people. A comment she has made elsewhere, about Mexicanos, as well. There is a strong attachment to her motherland, and Susana, in no uncertain terms, reflects that in her present and future.

Susana's view of play. Returning now to the previous conversation with Susana, it was an hour into that discussion, that Susana abruptly interjected,

Susana: Estos no juegan conmigo asi. [They don't play with me like this.]

Rosi: No te entiendo, ¿quiénes? ¿cómo? [I don't understand you, who? how?]

Susana: Mis hermanos. No me hablan como tú, así como estamos ahora. [My sister and brother. They don't talk to me like you do, like we are doing right now.]

Susana's comments came as a revelation, for we had previously never thought of Susana and Rosi's interactions and discussions as play. Yet, not to diminish their importance nor significance, Susana regarded them as such. Consequently, we began to reflect on our observations of children's actions, and found that children's activities before and after school, in the hallways, in the cafeteria, and on the playground, what would otherwise be play activities, entailed quite a bit of talking and interacting. In fact, this sort of play was far from the game role playing and imaginary roles younger children may partake of, but a genuine interaction. One, which if we may add, is enjoyable to the children. And it is also true that in the middle school, especially, children do not play games, per se. They meet, eat and talk in groups. In the lunchroom, for example, they joke around and laugh; they amicably joust with each other; they console each other during difficult times; they protect each other from the exerting forces of others; they share each other's lunches; and readily pool their resources, i.e. money, food, lunch passes. But this play is real, it is based on an instinct of survival. On the other hand, the role playing games which the school deems necessary for the children's development, are met with dissatisfaction. Children vehemently avoid participation by trying ever so desperately to 'blend' into the surroundings, and not be called upon to perform. In game activities of their own undertaking, children do not simply adopt a role, the activity involves talking and a general feeling of camaraderie.

El'konin's (1980) chapter on the historic origins of protagonist play, that is play which is modeled on adult activity, is important to our discussion of play, in understanding the social nature and historical origins of play itself. El'konin's (1980) description of this phenomenon is as follows,

> They are protagonist play in which the children reconstitute not only a sphere of adult work inaccessible to them, but also the domestic chores in which they participate directly. (p. 65)

The distinction to be made, is that this protagonist play, unlike forms of activity which preceded it, no longer holds productive values for the adult world. It is an activity which is an adaptation of former productive activities of the child. For example, the young boy who was trained to use a miniature bow and arrow set, as a precursor to the actual hunt, did so not as play, but in preparation for productive value to the family. His use of the bow and arrow constituted his participation in the adult sphere of work. A later child began to play with a reduced version of the actual bow and arrow, and did so for no sole reason, but the imitation of an adult role no longer accessible to him (El'konin, 1980, p. 64-65).

As we have stated, the role of protagonist play was preceded by two other roles, for example, initially, the child was directly incorporated and participated in the production. This period was followed, as the difficulty of the task increased, by a period of apprenticeship, eventually leading to productive activity. With the further complication and technicality of the task and tools involved, the child became obsolete and no longer productive. The continuation of earlier uses of the productive nature of child's labor, without its productive value, became the protagonist form of play. The historical origins of protagonist play, though, are as difficult to document as are histories of childhood (Ariès, 1962, 1982; deMause, 1974, 1987; Hawes & Hiner, 1991), namely due to the paucity of documentation of children's activities and lives (El'konin, 1980).

El'konin (1980) writes that "it is always the adult who introduces toys into the life of children and teaches them to manage them" (p. 45). Hence the permeation of certain games and toys throughout history. Children, themselves, do not come into this life with their own games and toys. So that we can well question which are actually games and toys of children's making, and which are of adult's?

Susana's comment on the conversation being play, is that much more interesting, we believe, because it points to that activity as a form of play, as perceived by children.

Unlike the competitive game playing enforced by the school, which is perceived as a distasteful and senseless activity, not play, as the adult perceives it.

Conclusion. Presently the origins of protagonist play, are to be found in the passing of time, "of the individual development of contemporary children" (El'konin, 1980, p. 68), not in an adult notion of what constitutes play. Is it possible then, that the protagonist form of play is being supplanted, by children, with meaningful forms of play, forms of play tied closely to their own development? This may well be the case. By means of understanding the child's social life, we find that contemporary childhood and play are very different from adult perceptions of the same. These perceptions remain too closely tied to adult-centric views, and ignore the socio-historical understanding of its nature and origins. As we have seen from the work of Nassaw (1985), Postman (1982), and Zelizer (1985), the concept childhood has taken many forms and shapes. Our understanding of present day childhood, is incomplete if we exclude the ontogenies of childhood which have preceded it (Venger et al., 1990, p. 27). We believe that Venger et al.'s use of the word ontogeny, makes reference to the developing nature of a child's place in society, the nature of which is always changing (Venger et al., 1990, p. 36). In this respect, the emic view of children's own social worlds allows for the portrayal of contemporary ontogenies, as does the now-adult emic view provide us with historical ontogenies of childhood.

There has been a loss of models or mediators as a result of historical periods of crises, which have separated even further the life of the child and the life of the adult,

> An adult appears to the child not as a representative or personification of another norm of social life, but merely as the bearer of specific features and qualities. (Venger et al., 1990, p. 39)

Such an adult fails to meet the functional parameters of the relational dyad and subsequently creates a break in the network of resources and a negative force in the child's development (Bronfenbrenner, 1979; Venger et al., 1990). In our own work, we credit the social mediations between Susana and Rosi as the fodder for our insights. These mediations allow for our growth and understanding of children's social worlds, and they conversely, provide Susana with potential adult models of what she may like to be, what she can be (Venger et al., 1990).

Another crisis in the context of our case study would be the migration of families to the United States, wherein children must break away from their previous lives, and the historical ontogenies of those lives, to a world which changes not only environmentally, but linguistically and culturally, as well. Unlike their parents though, who are also undergoing a form of socialization into the host country, children have very little say in the formation of their new lives. They must attend schools and learn the customs and language of the host country. Parents, on the other hand, given their adult status, can enroll in English as a Second Language courses at their own pace, and their dealings with the host country are not as direct, given the general nature of their employ, i.e. laborer, dishwasher, housekeeper, or child caretaker.

Further, we ask, what ramifications would a historical approach entail? In terms of the non-adaptiveness of the child, it would for example, in research translate into the rejection, which we have alluded to earlier, of the notion that in studying children's social lives, "it is unexpected for an adult to 'hang out' with children's groups," and that "legitimate adult-child interaction depends on adult authority" (Fine & Sandstrom, 1988), which as we found in our work, is a key to gaining access into the social lives of children. Currently, our research continues to strive for an understanding of not only historical ontogenies of childhood, but contemporary ones as well, in order to better understand the social construction of childhood in South Tucson.

In schooling practices, the non-adaptive nature of children would call for a reexamination of cultural, adult inventions of schooling, and require the cooperation between children and adults in revamping an educational system which insists on practices which have consistently failed to provide the necessary mediators for children's development, and which in the process have limited their own potential as institutions of greater learning. In this respect, Venger et al. (1990) write that El'konin's position was

> not to adapt the child to the established system of educational institutions, which, as it were, existed outside him, but, on the contrary, to transform that system of upbringing in the direction of greater mutuality and commonality between children and adults, toward discovering their constructive potential with regard to one another. (p. 26)

Our hopes for the future of our own work are that we continue to examine the child-adult relationships so deeply embedded in our social practices, in an effort to question those well accepted, yet often irrational practices, which lead to the child's loss of mediators, and the adults' direct role in that loss.

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Resumen. Se describe en este artículo una investigación conducida con la meta de entender al mundo social del niño. Al combinar las ideas teóricas de El'konin sobre la naturaleza histórica de la niñez con un estudio particular de la vida de una niña dentro y afuera de la escula, nuestro porpósito es doble. Primeramente deseamos elucidar la importancia teórica en estudiar la vida social del niño, y segundo ilustrarémos unas perspicacias que se ganan sobre niños, al lograr sus perspectivas y entendimientos sociales.

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Working with a Teacher in the Zone of Proximal Development: Action Research on the Learning and Teaching of Science

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Abstract. The author details his yearlong collaborative working with a teacher who wanted to improve her teaching of sixth grade science. In this case history of action research, the author as consultant did not want to dictate to the teacher what to do to better her teaching. Instead he strove to serve as a colleague interested in helping her observe, analyze and improve her teaching by herself. In this cooperative venture, both professional participants focused on the zone of proximal development, how to improve what they were doing in the here and now. Problems and outcomes are discussed in detail.

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How should one teach science to eleven and twelve-year-olds? This is the question that Jackie and I have been exploring over the course of this school year. Jackie is the teacher of a grade 6 class in a public school serving a multi-ethnic community in Greater Toronto. Her interest in this question is a very practical one: she wants to improve the learning opportunities she provides for her students in this area of the curriculum. As a researcher and teacher-educator in the University of Toronto, my emphasis is rather different. Certainly, I want to support Jackie in her endeavour; like her, I also want to learn more about the learning and teaching of science, although from a more theoretical perspective. And third, I want to get better at doing both of these things through reflecting on the way in which I do them. The method through which both of us are trying to achieve our objectives is that of collaborative action research.

In this paper it is the third of these objectives that I intend to focus on. My purpose is to present a number of critical episodes from our collaboration in order to raise for consideration some of what I believe to be the most important issues to be faced in undertaking work of this sort. In a nutshell, my question is: How should one enact the dual role of teacher-educator and researcher in the context of a classroom-based inquiry which is simultaneously a form of teacher development? Before launching into an account of this particular case study, however, it is important for me to make explicit my underlying assumptions about the nature and purpose of teacher development.

Situating Teacher Development in Context

Any discussion of the form that teacher development should take must start with a consideration of the goals and means of education more generally. However, this in itself is a controversial issue for, while within Western culture there is almost universal agreement that it is necessary for young people to engage in institutionally organized, systematic learning, there are also substantial disagreements about what the goals of this learning should be and about the means by which they should be achieved. To a large extent, these disagreements are rooted in the competing interests of the different groups within the power structure of society, and are thus ideological rather than theoretical in nature. However, they are also influenced by beliefs - usually unexamined - about what education should be, based on the particular practices that members of these groups experienced when they themselves were students. Thus all contributions to the debate about education - or indeed to any significant debate - are inevitably historically and culturally situated; they are also political in nature. On a personal level, then, one cannot be disinterested. So, rather than hide behind some spurious mask of objectivity, I wish to reveal my personal biases by making clear the assumptions on which this paper is based.

Clearly, I cannot divest myself of my own experiences as a student, first at a well-known `public' school in England, where I boarded during term-time from the age of ten until interrupted my formal education for two years of conscripted national service; then subsequently at a prestigious university. Nor can I deny my origins in the impoverished professional middle class of a country which once ruled an empire and still (secretly) believes in its inherent superiority, linguistically as well as culturally; nor my present status - for what its worth - as a Professor of Education, in a different country, which is still coming to terms with what it means to be large geographically, relatively small politically, and very definitely multicultural in fact and also in aspiration. I report these autobiographical details, not as credentials, but in order to emphasize the cultural and historical background against which my own personal beliefs and values have developed. However, just as important, if not more so, I believe, in accounting for their evolution, is the fact that, in the early stage of my career, I was a teacher of English, not only in England, but also in France and in Ghana, one of the erstwhile British colonies; then, after several years spent in teacher education, I devoted fifteen years to a large-scale longitudinal study of first language development (Wells, 1986). It was these latter experiences, in particular, that led me to think more deeply about the goals and means of education.

From my personal perspective, it seems abundantly clear that there is much that is unacceptable about the conditions that we have created for human existence on this planet, from the inequalities of power and economic well-being between developed and developing nations and, within them, between majority and minority groups, to the usurping of power over minds by the industries of mass entertainment, and the unbridled materialism that is destroying the ecological environment which makes human existence possible. I also take it as self-evident that one of the means whereby we can hope to make the necessary changes in our way of living is by educating those who will be the decision-makers of tomorrow to understand the need to act differently. Along with the acquisition of subject-based skills and knowledge, therefore, the goals of education must clearly also include a new emphasis on issues of equity and of civic and ecological responsibility.

On these goals there is probably quite substantial agreement. However, little will have been achieved if our students merely know what changes in our way of living are necessary, if they have not also developed the disposition to make those changes that are within their power to effect. A further goal of education must therefore be to develop students who are critical and creative thinkers and problem-solvers, who not only know what needs to be done, and why, but who also have the determination to make the necessary changes, both individually and in collaboration with others.

This brings us to the means of education, about which there is much less agreement. Nevertheless it seems equally self-evident to me that, if these latter qualities are what we hope our students will manifest in their daily lives after they have completed their education, they must also be developed and encouraged throughout the course of their education, in all the activities that they undertake. Schools must therefore be places in which students are apprenticed into a way of living - of thinking, feeling and acting - that is informed by the values that I have just described and which are already practised by the adult members of the school community.

Once this is accepted, it follows that those who are to be responsible for our students' education must themselves be educated according to the same principles. For we can hardly expect teachers to create the conditions in their classrooms for students to develop these dispositions if the teachers themselves have not had similar formative experiences. Nor can students be expected to develop confidence in their own knowledge and judgment, while recognizing the benefits that are to be gained from collaborating with others, if those who teach them have been trained unquestioningly to implement the decisions of others and are given no encouragement to take initiatives in collaboration with their colleagues.

It is clear, therefore, that if we wish to change schools so that they become places in which students acquire the dispositions as well as the knowledge that will enable them to change the societies of which they are members, we must also change the conditions under which their teachers' education and professional development takes place. This includes giving teachers the opportunity to develop their own expertise in planning and enacting the curriculum through critical inquiry into their own practice, which is conducted in collaboration with their colleagues.

Action Research as a Mode of Professional Development

During the last two decades, support for such a conception of teacher development has come from a number of quarters. Although differing in their theoretical underpinnings, what all have in common is an emphasis on encouraging teachers to take a more agentive role in educational decision-making and, as I have argued elsewhere (Wells, 1992a), this inevitably involves their taking a more intentional stance to their own learning and professional development.

At the institutional or administrative level, the impetus for change has come from the evident failure of traditional methods in bringing about desired changes in educational practice, particularly in the areas of curriculum development and implementation. In the past, most attempts to change classroom practice were conceived in the managerial tradition of hierarchical control. Experts - often educational researchers, who had no first-hand knowledge of the variety of conditions that teachers had to contend with - were consulted in order to determine what changes were necessary and their recommendations were then imposed by administrative mandate, and teachers were trained to implement them, whether or not they believed in them or considered them relevant to the particular circumstances in which they worked. By the early 1980s, however, evidence had accumulated which showed that this approach was rarely successful, and various attempts were made to devise alternatives which gave teachers a greater role in the determination of what needed to be changed and how (Fullan, 1982, 1992).

One of the first to advocate a more agentive role for teachers in the development of curriculum was Lawrence Stenhouse, whose work on the Humanities Project in Britain was to initiate a tradition of grass-roots involvement by teachers, which has borne fruit in a variety of innovatory curricular projects (Elliott, 1990), including the Science, 5-13 Project (Harlen, 1975) and the National Oracy Project (Norman, 1992), whose ideas have influenced the work to be reported here. The latter project, in particular, which has involved teachers and local advisers in a wide variety of investigations aimed at enhancing the role of spoken language in all areas of the curriculum, has shown just how effectively teachers' classroom inquiries can put flesh on the bare bones of curriculum policy which is centrally planned (Wells, 1992b). It is ironic, therefore, that the implementation of the National Curriculum in Britain is now reverting to the discredited administrative model, which imposes change on teachers rather than inviting them to be active partners in the decision-making process.

A second perspective on teacher development, springing from Dewey's emphasis on `learning by doing', is found in the work of Donald Schön (1983, 1987) on reflective practice. It is often said that teaching necessarily involves monitoring ongoing practice and making the necessary adjustments to attain one's planned objectives. However, this sort of `knowing-in-action', as Schön calls it, while being a characteristic of skilled behaviour, is not sufficient for the development of further expertise. For this sort of learning to occur, we have to be open to being surprised, and to respond to the unexpected by `reflection-in-action', in which we seek to understand what before was taken for granted and, through experiment, to change things for the better. A further stage of reflection *on* reflection-in action is then required in order to be able to give an account to others of what was learned in the process.

Development as a teacher through reflective practice thus involves being willing to treat various aspects of one's teaching as problematic and to attempt consciously to understand the complex interplay of factors that accounts for particular events and outcomes. Because each classroom situation is unique in its configuration of possibilities and constraints, Schön, quoting Dewey, emphasizes the need for every teacher "to *see* on his own behalf and in his own way the relation between means and methods employed and results achieved" (Dewey, 1974, p.151 in Schön 1987, p.17). In recent years, Schön's ideas have found many advocates among teacher-educators, such as Connelly and Clandinnin's (1988) work on personal practical knowledge and narrative inquiry, and Newman's emphasis on `learning to teach by uncovering our assumptions' (1987, 1991).

A third, more ideologically oriented, approach is to be found in the work of Stephen Kemmis and his colleagues (Carr and Kemmis, 1983; Kemmis and Fitzclarence, 1986). Owing a debt to Habermas's (1984) work on critical theory, the goal of the action research that they advocate is critical and emancipatory and, in its emphasis on the cyclical nature of the process and the importance of the action component, it is both more systematic and more oriented to institutional change than is the work deriving from Schön's `reflective practice'.

All of these approaches to teacher development through self-initiated classroom inquiry can throw light on the case study to be presented here. However, the perspective that I have chosen to adopt on the present occasion is one that is derived from sociocultural theory, that is to say from the insights about learning-and-teaching that I have gained from the writings of Vygotsky (1978, 1981) and of Leontiev' (1981), and from the work of those who are still developing this theory (Cole, 1985; Moll, 1990; Wertsch, 1985; Wertsch and Toma, 1990).

Like Dewey and Schön, writers in the tradition of socio-cultural theory also emphasize the importance of learning in action. However, what distinguishes this school is the recognition of the cultural embeddedness of action and of the central role of the cultural artifacts that are used to mediate the achievement of action goals and to solve the problems that quite frequently arise in dealing with the particularities of specific situations. The continuing existence and use of these artifacts also plays an important role in the learning of successive generations, as they take over the related cultural knowledge and practices and transform them into a personal resource for further problem-solving in their own lives (Cole, 1991).

It needs to be emphasized, however, that these artifacts include not only material objects such as knives and pots, institutions such as the family or the law, and practices such as the division of labour, but also those intellectual artifacts and practices which mediate the organization of all material activity, such as the conventions of measurement, of information storage and retrieval and, above all, the linguistic discourse, both spoken and written, through which joint activity of all kinds is negotiated and theoretical understanding developed and communicated.

Described as an `apprenticeship' (Rogoff, 1990), learning, according to this theory, is best understood as the appropriation of the resources of the culture through participation in joint activities. In such activities, these resources - both the artifacts and the knowledge and practices associated with them - are demonstrated and explained in action and the learner is guided and assisted in making them his or her own. This is not simply a matter of `copying', however. For the internalization of the organizing cognitive structures associated with a particular action necessarily involves a transformation: a transformation of what is appropriated, as it is assimilated to the learner's existing cognitive organization, and a transformation of that organization, as it is modified to accommodate what is being appropriated. As Nicolopoulou (1991) puts it, "`internalization' has occurred when the individual's cognitive structures have been reshaped in ways that influence and direct subsequent mental activity", and, one should add, his or her performance of the relevant social and material actions. Furthermore, it is because internalization necessarily involves these two kinds of individual transformation that learners, in turn, are able on occasion to transform the problem situations they encounter, either by proposing novel solutions to them or by seeing new applications for the artifacts that they have appropriated (Engeström, 1991).

A further important dimension of this theory of learning-and-teaching concerns the support and guidance that the learner receives when engaging in joint activity. As Vygotsky (1978) points out, the most effective teaching is that which is in the learner's `zone of proximal development' (ZPD), that is, in the zone of competence that lies between what the learner can manage alone and what he or she can achieve with help. In order to provide this sort of assistance, however, the teacher has to be alert to the cues that the learner provides concerning the sense that he or she is making of the task in hand; the teacher also needs to know when and how to intervene so that the learner is able to achieve greater success in the current task and also to appropriate and internalize further elements of the organizing cognitive structures. For the aim of such teaching is always that the learner should achieve autonomous mastery of the task as quickly as is practicable and be able to function in the future as an independent and creative problem-solver in situations of a similar kind.

In describing learning and teaching in the zone of proximal development, Vygotsky was thinking particularly of situations in which children are learning with the assistance of an adult or more competent peer. However, in principle, this concept applies with equal validity to learners of any age. Furthermore, the difference in competence that he described needs to be seen in relation to the task in hand rather than in global terms. So it is possible for two or more people of equal status to collaborate on a task in such a way that each provides support to the others from his or her areas of expertise and similarly receives support in areas in which the others are more expert. That is to say, support in the ZPD can be mutual. Ideally, this is the situation which obtains in collaborative group work, whether it is elementary students engaged in a curricular activity or teachers and teacher-educators engaged in collaborative action research.

Thus understood, teacher development can fruitfully be seen as a form of professional apprenticeship in which teachers take over the solutions to past problems embodied in the artifacts, both physical and intellectual, which they encounter in the joint activities they undertake with other professionals. In the process, not only do they develop new ways of acting and understanding, but they may also radically transform the situations in which their actions are performed.

As I have already made clear, I do not want to claim that this is the only - or even the best - way of thinking about teacher development. Nevertheless it has the advantage of drawing attention to a number of critical features. First, it emphasizes the constructive nature of learning, and its basis in practice. In this, it avoids the unfortunate imbalance that has characterized so much professional education, in which either theory or practice has been emphasized to the near exclusion of the other. A sociocultural perspective, by contrast, sees the relationship as dialectic: theory grows out of practice, which, in turn, is informed and illuminated by it. Second, by emphasizing the importance of problem-solving in the course of activity as the prime basis of learning, it recognizes that learning is, in general, both innovatory and context-specific. In this, it matches well with the contexts in which teachers perceive the need to develop their expertise, namely problems of practice in their own classrooms which, as Schön (1987) points out, involve uncertainty, uniqueness and conflicts of value. Third, by emphasizing the essentially social nature of learning, it opens the way to the development of genuine collegiality amongst teachers, as they discuss their problems with colleagues and resource personnel from outside their classrooms and share their solutions and insights through informal talk and through various forms of more formal dissemination. Finally, and perhaps most importantly, this perspective provides a theoretical framework for those who are themselves responsible for the education and development of teachers.

In recent years, various approaches have begun to emerge that possess some of the characteristics just outlined. These include `mentoring' and `peer-coaching' at the inservice level and school-based preparation and induction at the level of initial preparation. However, in many cases, the impetus for these practices continues to come from administrative decisions taken outside the classroom, with the result that teachers are to varying degrees still coerced into what Hargreaves (in press) calls situations of "contrived collegiality." In contrast, teacher-initiated action research, in which a teacher identifies an aspect of his or her practice to treat as problematic and engages both in systematic observation and reflection with a view to action, and in discourse through talk and text in order to learn from and with others, seems to have the potential of realizing all the advantages discussed above.

The case study which constitutes the remainder of this paper is presented as an instance of this kind of teacher development, undertaken in the context of a collaborative classroom inquiry. It is, in effect, my attempt to conduct a piece of action research on the doing of collaborative action research.

The Negotiation of Collaboration

I first met Jackie in July 1991, shortly after the end of the school year. She had just accepted an appointment to teach a grade six class in the school in which we were working and to act as the lead teacher for that grade level in the school. Our meeting was very much exploratory, for she had found herself in the somewhat difficult situation of replacing a teacher who had been promoted out of the school after volunteering to be one of three with whom we carried out a collaborative investigation into the role of language in the learning and teaching of science.*

I was both chagrined that our original plans had been thwarted by this change of personnel and also sensitive to the fact that, as the incoming teacher, Jackie would inevitably feel under some pressure to agree to participate in the project.

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From past experience I have learned that action research, to be effective as a mode of professional development, must be undertaken on a voluntary basis. Inevitably, a certain amount of extra work is involved: in collecting and analysing data, in writing, and in meeting with colleagues. More importantly, it requires the teacher to put her or himself at risk by identifying some aspect of her or his practice that is to be treated as problematic and perhaps in need of change or improvement. When this self-evaluation is voluntarily undertaken it is an opportunity for personal growth; when it is felt to be imposed, it naturally arouses feelings of hostility or resentment.

In this respect, action research undertaken collaboratively between teachers and university researchers is doubly problematic. In addition to the difficulty of ensuring that the teacher participants are taking part of their own free will, rather than because they feel under some institutional pressure, there is the further difficulty that the university personnel will already have their own research agenda which was developed independently of the teacher participants. In this situation, there is an ever-present danger that the teacher's agenda will be subverted by the researchers' need to fulfill objectives agreed upon with the funding agency in advance of the contract of collaboration. And, even if this is avoided, there still remain the inequalities of role and status that privilege the researcher but at the same time require of him or her the production of publishable evidence of worthwhile outcomes to justify the financial support received.

Aware of the delicacy of the situation, then, I was at pains, in our first conversation, not to put any pressure on Jackie to take part in the project. I described our plans in general terms and she talked about her previous teaching experience, which had been in Special Education. She told me that her area of expertise was in the use of literature as an entry to work in other areas of the curriculum for children with special needs. She was, in fact, just completing a research project, for which she had received study leave, the purpose of which was to document the literature resources most useful for such a programme. Of the teaching of science at the grade six level, on the other hand, she had no previous experience, although she expressed an interest in making connections between the work she was completing and this new (for her) area of the curriculum.

The outcome of our meeting was that Jackie expressed her willingness to take part in the project, although, at this stage, she was not at all sure what exactly she was agreeing to. And, on this positive but indeterminate note, we parted for the summer, although not before I had handed over `a little light reading' (including Eleanor Duckworth's (1987) collection of essays entitled *"The having of wonderful ideas" and other essays on teaching and learning*), with the suggestion that they might provide an orientation to the sort of collaborative work we had in mind.

Getting to Know Each Other

The new school year did not start propitiously from our point of view. Our plan was to observe the first unit of science taught by each of the three teachers and to use the video-taped data and transcripts of co-investigatory interviews with selected children as the basis for exploration of issues that the teachers might select for collaborative investigation. Our expectation was that each unit would last a month or a little longer, leaving us the remainder of the first term to work on the data and engage in a series of meetings with the teachers in order to determine what we would focus on in the second round of observations to be conducted in the first unit in the second term. In practice, in all three classrooms the first unit lasted much longer than six weeks and, in Jackie's class, the period was further extended by her delay in starting because of a variety of factors resulting from the additional responsibilities she was assuming as lead teacher in the school. It also gradually became clear that she felt more than a little uneasy about teaching science at all, given her image of the subject and her own lack of expertise in this area.

Like many teachers, Jackie felt overwhelmed by science. In part because of her own education and in part because of the image that is assiduously projected by the scientific community, she saw science as a body of arcane knowledge that could only be understood by the experts. Within the teaching profession, some teachers belonged to this club of experts, and it was they who constructed the curriculum on the basis of their specialist knowledge, selecting which facts should be taught and in which order. The responsibility of other teachers - the uninitiated - was to transmit this body of facts to the students and then to test them to make sure that the facts could be reproduced on demand. Jackie felt uncomfortable about accepting this responsibility. In the first place, she did not herself feel sufficiently knowledgeable about scientific topics to be the dispenser of knowledge to others; and, in the second, she did not practice this approach to teaching in those areas of the curriculum in which she did feel knowledgeable. As a result, she had in the past simply avoided this dilemma by concentrating her efforts on other subjects. Now, however, having undertaken to take part in our project, she felt herself under an obligation to adopt a more proactive stance.

What Jackie did not know, at this point, was that the positivist view of science and science teaching that she found so oppressive was already being doubly challenged. In the philosophy of science, it has come to be recognized that scientific knowledge is not an independent body of universal truths, but the collection of propositions, descriptive and explanatory, that, at any moment, is in the ascendancy in the debates which are ongoing in the relevant scientific community (Hawking, 1988). From work in the human sciences it has also come to be recognized that knowledge - in science as in any other area of human endeavour - is both personal and subject to modification and revision, as the individual knower brings what he or she already knows to make sense of new information, testing that knowledge against further evidence, calibrating it against the opinions expressed by others, and changing it as seems to be necessary (Bentley and Watts, 1992; Howard, 1987).

This changing conception of science, with its far-reaching implications for the science curriculum, had already had an impact on the thinking of the educational policy-makers in Ontario. *Science is Happening Here*, the policy document for the elementary years published by the Ontario Ministry of Education in 1988, makes clear that the aim of the learning and teaching of science in the primary and junior years is to engage children in experiment and discussion about the questions that interest them in their physical and social environment. That this was also the policy of the School Board was confirmed in a meeting we had, during the course of the year, with the Coordinator for Science. As he explained:

> There's a vision about what we want science education to be like, which is I think quite similar to the vision we have for education in general ... I'm talking about a shift from a content emphasis - facts as it were - to a more generic skills-based approach in science ... And by skills I mean broad problem-solving - a whole range of things, not just physical manipulation of equipment, but the broader sense of skills. Some people call it the big ideas of science. Some people call it a conceptual framework." (Interview, 3 February, 1992.)

In many ways, then, this was an ideal situation for our joint investigation: the approach to science teaching that we were hoping Jackie would adopt was fully endorsed by the school system, and Jackie herself was keen to develop greater expertise in this area of the curriculum, although without knowing, at this stage, what this would entail.

In fact, it was not until November that the agreement to engage in a collaborative inquiry was made. By then Jackie was in the middle of her first science unit, which was on the topic of 'space'. This had not been her own choice, as it had already been planned by her predecessor. However, she had arranged for her class to make several visits to a local science centre, where the resident personnel had provided interesting input in a lecture mode and, back in the classroom, she was drawing on her own expertise in organizing library-based research to support her students in developing group projects on space topics of interest to them. Nevertheless, as she was only too painfully aware, this was a very makeshift way of proceeding and she was anxious to develop an approach in which she could be more centrally involved.

The first move came from Jackie, when she asked me to help her prepare her application for admission to the Masters' programme at OISE. As we discussed the courses she might take, including the action research course that I myself teach, we hit on the idea of her undertaking a practicum in science teaching during the current year which, if her application were accepted, could count for credit towards her degree. From that point on, we began to meet on a regular basis one afternoon each week after school to discuss the work she was doing and planning in science.

From the beginning, I recorded two copies on audio-tape of each of our discussions. One copy was for the purposes of the funded research, so that it would be possible to investigate the process of collaborative action research. But an equally important purpose was to give practical expression to the principle of Jackie's co-ownership of our inquiry. I hoped, by handing over the second copy of the recording at the end of the meeting, to reassure her that I was not collecting evidence to which only I would have access. I also knew from past experience in another large-scale action research project in which I had been involved ('Talk: a Medium for Learning and Change', Booth and Thornley-Hall, 1991) that teachers found it useful to have a record of their discussions with me about their inquiries. As they listened to the tape later, when driving to work or doing some household chore, they had the opportunity to reflect on what they themselves had said and to develop more fully ideas that had only been briefly touched on in the course of our conversation.

In addition to tape recording our conversations - one of which was conducted on the telephone - I managed to arrange for Jackie to obtain a modem and an account on the OISE mainframe computer, with the result that, from the end of January onwards, we were also able to communicate by e-mail. This had several advantages.

Often, we wanted to discuss what had occurred during the course of a lesson but were not able to talk at length immediately afterwards. Writing in the evening or at the weekend enabled us to keep the progress of the students' learning under review. However, the main advantage was the greater reflectiveness that is induced by writing. I tried to establish the convention of waiting to read what Jackie had written before offering any views of my own. When I received her message, however, I would intercalate my comments and suggestions in response to each paragraph-sized unit in her original, and then send back the resulting dialogue-type text in full.

Initially, our discussions circled around three major themes. The first was the new approach to science teaching in general, and we frequently talked about the status of theory in the sciences and the relationship between theory, observation and interpretation. I was trying to help Jackie to understand the conception of scientific knowledge as a cultural construct, generated through social activity in which the members of the scientific community use the existing resources and practices of their culture to solve the problems encountered in their attempts to achieve socially agreed-upon goals. Chief among these resources is language, which not only encodes - and thus allows participants to refer to - the relevant elements in the problem situation and the hypothesized relationships between them, but also enables them to make claims, adduce evidence, raise objections - in short to engage in scientific discourse according to the conventions and values that govern that genre of activity in their community. By the same token, I suggested, learning science is best seen as an apprenticeship into this community, as students carry out practical activities in relation to their chosen topics and engage in discourse, in speech and writing, to make sense of their observations and the questions to which they give rise.

The second theme was much more practical: what would be an appropriate topic on which to try out this new approach? In contrast to the ongoing unit on space, which had perforce become an inquiry based on print resources, we wanted the next unit to provide an opportunity for some empirical investigation. Together, we consulted the Board of Education's curricular guidelines in search of a suitable topic, and one for which there was already a kit of materials available. Finally, we selected the topic of pendulums, as the suggested experiments seemed to be relatively straightforward; it also had the potential for leading into a variety of interesting further investigations in relation to the larger topic of `time'. Having chosen this starting point, much of our discussion was then concerned with how the topic might be developed and with what preparations Jackie needed to make.

The third theme that occupied us was the nature of our own collaborative inquiry. Just as the conception of science that I was introducing was new to Jackie, so too was the idea of action research as a valid mode of teacher development. Initially, Jackie expected me to give her specific advice on what and how she should teach; she was therefore more than a little disconcerted when she discovered my reluctance to do so. Never having taught science myself, I certainly did not have ready-made solutions to the problems that she raised. But, more importantly, my intention was to persuade her that the best answers would be those that she made for herself, as she explored the possibilities inherent in the triangular relationship between herself, her students and the topic that they were jointly investigating. My role was not to provide answers, I explained, but to help her to construct her own. Our collaborative action research was thus in many ways parallel to the approach to the learning and teaching of science that we were also exploring.

An indication of the difficulty we experienced in arriving at a mutual understanding on this point can be seen in the following quotation, in which Jackie's sense of frustration is clearly evident. In answer to her preceding question, I had just started to explain what I understood by action research when she interrupted:

> I feel I have to follow a formula for you for this project, and this, for me, is very frustrating because I don't have reinforcement of 'Yes, I'm going two steps forward, or no, I'm going two steps back.' Am I doing the right thing? Am I in line with what you're looking for? Just some validation of 'Yes we're getting something useful.' That's basically where I stand and every time we leave I think 'Was I clear? Did I say what I really was thinking?' Are you waiting for me to come up with what you're looking for? I'm used to somebody saying: 'Five things on this research: do that, do this, do that.' I don't know what you're looking for. So I want to know if what you're looking for is what I'm looking for. (12 December 1991)

Negotiating the Topic for Inquiry

Jackie was not alone in being disconcerted by the role that the research team was trying to adopt. In discussions with all three teachers, we met the same request: "Tell us what you want us to do." Our response - that we had no predetermined agenda but that what we wanted was for them to identify some problematic aspect of their science programme that we could investigate together - met, initially, with scepticism or bewilderment. To a considerable extent, I believe - as Jackie's remarks indicate - this reaction was due to the unfamiliarity of what we were proposing when compared with the much more directive approach which had been their previous experience of educational research and development.

But the teachers were also responding to a very real ambivalence at the heart of our project. For we did indeed have a 'hidden agenda', which was to use the data collected in their classrooms to investigate the role of language in the learning and teaching of science. And, to pursue this agenda, we needed to record episodes in which language was being used productively by the students as a tool for making sense of the scientific topics under investigation. In our estimation, the discourse that occurred in the episodes that we had observed and recorded in the first unit in each classroom was not engaging the students as fully as we had hoped. But to say so would have been counter-productive, as it would simply have confirmed the teachers' suspicions that our real purpose was an evaluative one: on the basis of our observations, we would tell them what they were doing wrong and offer recommendations as to how they could do better. They were, of course, right in thinking that we hoped to see improvement. But what we were obviously having difficulty in communicating was our conviction that the most valid sort of improvement would be that which they themselves decided to institute, as a result of their own reflective evaluation of what they were currently doing.

Following a meeting in January with all three teachers, at which this request for a clarification of our expectations was made yet again, I wrote a reply, from which the following paragraphs are taken. I started by describing the approach to the learning and teaching of science that I outlined above and then I continued as follows:

> It seems pretty obvious that not all ways of organizing the teaching of science are equally effective in providing opportunities for students to develop their understanding and show evidence of what they have learned. The major purpose of our research is to work collaboratively with teachers to explore what are the most effective ways. We certainly don't know the answers, although we have some ideas about what are likely to be more and less effective approaches. Nor do we believe that there are any answers that will be true in all classrooms, since what is effective in one classroom may be less so in another. Much will depend on the characteristics of the particular group of students, on the characteristics of the teacher, on the conditions under which they work, and probably also on the topic that they are working on.
>
> Our purpose, then, is to offer support to each teacher as she tries to find the most effective way of working

with a particular group of students on the topics that are selected for study. This is why we use the term ‘collaborative action research' to describe the sort of research we are trying to do. ...

You asked how we ‘measure' how effective the different types of learning-and-teaching are. There are a number of ways in which this can be approached. One is through relatively formal tests - though this is not our preferred approach. A second is by means of interviews with selected students at the beginning and end of a particular unit: by comparing what they know about the topic before and after they have engaged in the activities that make up the unit, we can form an estimate of what they have learned. A third way is by studying what they do and say while they are engaged in the various activities, using the evidence that we have recorded on videotape.'

This latter method is of particular value for collaborative action research because the video-recorded evidence not only gives an indication of what and how the students are learning, but it also provides a basis for considering how to improve the learning opportunities that are being provided - by maximizing what seems to be most effective and minimizing what seems to impede their learning.

Of course, we do not start without any hypotheses. We believe that learners actively construct their knowledge through trying to make sense of things that interest them. We believe that problems that engage their interest are likely to be more effective than routine tasks for which they can see no purpose. We believe that dialogue with others (peers, teachers and other more knowledgeable others) - through talk and

> through reading and writing - is of great importance. But these are hypotheses, to be tested through research, and refined, modified or rejected in the light of the evidence.
>
> By engaging in collaborative action research we hope not only to increase our theoretical understanding but also, and most importantly, to enable all concerned - students, teachers and researchers - to gain from the experience.

This statement of our aims certainly had an effect, for it led one of the three teachers to decide against becoming any further involved in action research. In retrospect, it is clear that we should have given each teacher a written statement of this kind at the point when we were soliciting their involvement in the project. If they had then decided against taking part we could have approached other teachers or designed the project differently. At that time, however, we were reluctant to take such a strong stand for fear of appearing to be too unilateral. In any case, we believed that we had adequately explained our hopes and intentions in our first conversations with the teachers, since they had each seemed willing to take part in a collaborative inquiry. Evidently, we had not been as clear as we thought.

Balancing the Agendas

For Jackie, on the other hand, the written statement did help to clarify the nature of the collaborative relationship that we were undertaking and, from then on, it ceased to be a problem for her. Nevertheless, for me, the question of how to reconcile the research team's two competing agendas continued to be a preoccupation as I met with Jackie to prepare for the forthcoming unit on time. On the one hand, I certainly did wish to see a change in the direction of students being encouraged to pose and attempt to answer questions that they themselves considered interesting. I also wanted to see them being given opportunities to state and justify their opinions in open-ended discussion. At the same time, I had an equally strong commitment to encouraging Jackie to make her own decisions about the changes she wished to make in the way she taught science, even if the direction she chose seemed to me to be less than ideal. Often these two aims came into conflict, as is well illustrated by the transcript of the meeting we had on 16 January 1992.

By this stage, as a result of her reading and our weekly conversations, Jackie had taken over the idea that the students should have a part in selecting the specific topics to be investigated. Indeed, on 19 December, in updating me about the work on space, she had commented "I feel that I've come a very long way because it [the students' choice of topics to research] is open-ended and there's excitement here." In thinking about how to organize the opening stages of the next unit on time, which she intended to start with some experimental activities with pendulums, Jackie was now concerned with the appropriate balance between student input and choice and her own control of the direction of the unit as a whole. "The question I have right now is: Do I structure the activities as we're going along, or do I structure the activities ahead of time without having any prior discussion?" (16 January 1992).

My initial reaction to this question was to ask Jackie to consider the advantages and disadvantages of each alternative, with the intention of helping her to make her own decision. When I now reread the transcript of the ensuing conversation, however, I can see that my contributions were not as impartial as I had intended. Shifting into the impersonal mode, I treated her to an account of developments in thinking about science teaching, which ended as follows:

> So that method [of teacher delivering the facts according to a preformulated curriculum plan] has meant that a lot of students have covered the topics in the curriculum but have ended up not actually understanding very much at all ... So the emphasis has moved to, not so much the facts, as 'doing science' - being struck by problems that you want to find an answer to and then developing, wherever it's possible, appropriate activities, observations and so on that will enable the students to see - understand the relationship between their question and their observations in the experiments and so on, and draw conclusions.

Not content with this only slightly veiled directive, I continued somewhat later with a further homily on the provisional nature of scientific facts and their dependence on theory, which is constantly being modified, revised and even occasionally abandoned in favour of an alternative. The point of this was clearly to reinforce her movement towards what she had called an 'open-ended approach' and to recommend the consideration of students' alternative points of view and conclusions.

However, pointing out that, as far as pendulums are concerned, the facts seem to be fairly well established, Jackie brought the conversation back to *her* problem. "What I'm having difficulty with in the pendulum unit is taking the activity and deciding now what's to be done, before I hear their questions." Jackie then tentatively rehearsed what she was currently thinking of doing and I made comments and offered suggestions. Finally, after several minutes of this sort of exploratory talk, I offered the following summing up.

> OK. Could I just recap a little. It seems to me that, following your introduction to this unit, the first problem that you're going to pose is: 'Do all pendulums swing at the same speed?' The answer will certainly be 'No.' 'What might make a difference?' And you wait and see from there, but you have some ideas about the sort of things that are going to crop up. One of the first is: How do you get accurate measurements of how long it takes for a pendulum to swing? What counts as a swing? How do you - And then the idea of doing more than one swing and taking averages. How do you record it? And then the different variables that the kids come up with and others that you might want to introduce if nobody else does. But they may come up with some ideas that neither you nor I would think of.

And so it continued until we had agreed on a format that met my ideas about how the unit should be organized.

In retrospect, I can see that the question that was concerning Jackie - to which I was so certain that I had the answer - was in many ways the same as the one I was struggling with myself, although, ironically, I was apparently not sensitive to this at the time. In my desire to make sure that she understood the advantages of allowing the students to have some part in determining what questions about the pendulum would be interesting to investigate, I was not allowing her freely to reach her own decisions about the best way to proceed.

However, I do not wish to suggest that the suggestions I made were necessarily inappropriate. Having decided to embark on a new approach to teaching in a subject area in which, on her own admission, she lacked both experience and a broad base of relevant knowledge, Jackie needed encouragement and support. What was less appropriate was the way in which my suggestions were made. Perhaps what saved the day was that Jackie understood my determination to ensure that she retained ownership of her action research project and knew that my suggestions, however forcefully made, were intended as such - possibilities to be considered, but accepted only when they made sense within her own developing theory of learning and teaching, as applied to the current situation. Suffice it to say, the initial stages of the unit on time did *not* unfold according to the plan that I had outlined. Jackie found her own solution to her problem.

Saving the Day for Science

Up until this point in the year, I had visited Jackie's classroom about once a week, often arriving for a science lesson and staying to talk after the end of school. The students were used to my visits and I was beginning to get to know some of them individually. Myriam Shechter was also a regular visitor. In addition to video-taping every science lesson, she also conducted coinvestigations with a representative subsample of the students at the beginning and end of each unit.

For the duration of the unit on time, however, I undertook to be present whenever a science lesson was scheduled and, apart from three weeks of enforced absence, I did indeed manage to observe every lesson. Initially, I tried to remain unobtrusive, not participating at all in whole class sessions and acting mainly as a sounding board as I talked with groups of students about the activities in which they were engaged. As the unit progressed, however, I became more drawn in to the various group inquiries and would occasionally accept Jackie's invitation to talk to the whole class when she thought something I had said to her in conversation would be appropriate to put to the students.

One of my earliest interventions was made at a difficult moment while the experiments on pendulums were still ongoing. Working in groups, the students had chosen a variable they wished to investigate, either the length of the string, the weight of the bob or the angle at which the bob was released. About the effect of changing the length there was no doubt: the longer the string, the slower the swing. But with respect to the other two variables, results were conflicting. To try to settle the matter, Jackie suggested that the experiments should be carried out by one of the groups involved while the rest of the class acted as observers to ensure that the test was properly conducted.

The first to go was a group of boys who had investigated the effect of changing the weight of the bob. Nir, Nick and Vi-Hung had arranged their pendulum in the shape of a letter `Y'. The string passed through two small eye hooks screwed into a horizontal length of wood and the two ends were then joined and firmly attached a few centimeters below the join to a large cup hook. To increase the weight, two extra washers were added to the cup hook for each successive pair of trials. On the first pair of trials they obtained a mean value of 57 swings in the measured 60 seconds; on the second 55.5, on the third 54.5, and on the fourth 53. At this point, they were asked to state their results and the conclusion they drew from them. Not surprisingly, they concluded that increasing the weight decreased the number of swings made by the pendulum in the 60 second period.

Knowing that, in principle, changing the weight of the bob does not affect the period of the pendulum, Jackie was inclined to dismiss the observed results as due to error. And certainly, most of the groups had not been very careful in keeping all but the relevant variable constant in the experiments they had conducted - which was the reason that groups investigating the same variable had obtained conflicting results. However, in this case, it seemed to me that the three boys had exercised considerable care and their results definitely showed a clear trend in support of their conclusion. At this point, Jackie turned to me and asked what I thought was the appropriate conclusion.

This was a difficult moment. I firmly intended not to interfere in Jackie's conduct of the lesson while it was in progress. On the other hand, I felt that, at this moment, an important scientific principle was at stake. Here was a potential opportunity to accept the unexpected result as valid and to try to find an explanation for it. Hoping that Jackie would not be offended, I supported the boys' conclusion and asked whether anybody could think what might have caused the pendulum to swing more slowly as the number of washers was increased.

Julia was the first to answer: "It could be getting heavier", she suggested, somewhat tentatively. Jackie agreed that it was indeed getting heavier, but why did that change the speed of the pendulum. At this point, Andrew raised his hand and was invited to speak.[*]

TEA: Andrew?

AND: Because whenever you put the weight- the weights on, the washers, right, the more heavier it got, the more skinnier the string got . because ** [his voice trails away].

TEA: Say that again . really nice and loud.

AND: OK . the more weights you put on, right, the- the more ... hea- ... pressure was going on the string. So then it got skinnier [speaking softly].

TEA: So it pulled the string longer therefore ... AND: - it got skinnier

Andrew's hypothesis was subsequently tested by Nir and was found to be correct. Adding more weights did indeed cause the

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[*] In this transcript, the following conventions apply: . =1 second of pause; <> enclose segments where the transcription is uncertain; * = a word that was inaudible; CAPS indicate a word spoken with emphasis; underlining indicates segments that were spoken simultaneously.

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string to stretch and, as the pendulum got longer, it swung more slowly.

The next group to conduct their experiment in public was a group of girls, who were testing the effect of varying the angle of release. They too obtained differing rates of swing on successive trials, but without any clear trend emerging. This time, Jackie asked the class whether they agreed with the girls' conclusion that changing the angle of release affected the rate of swing. Wayne did not.

WAY: It's all wrong . the whole thing
is wrong ... But I don't want to
do it again

TEA: No, we won't do it again

WAY: I'm just saying it's all wrong
because . how they're putting
it, it's on a slant

TEA: Yes
WAY: So it's curving this way . and it
slows down so it just moves little
by little
So I'm saying that this thing should
be just erased and forgot about .

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it's all wrong

TEA: You don't think it's a fair test

STU: Yeah, agreed

WAY: No

[After a few more turns, TEA turns to Benjamin]

TEA: OK, so, Benjamin, do you have something to add to that?

BEN: Yeah, I don't think there should
be any conclusion to this . it
wasn't straight or anything so
it's not even accurate. So you
don't know if it's right or if
it's wrong

TEA: So you don't think this was a
fair test?

BEN: No

This brought the lesson to a close. Clearly, there was still more experimenting and discussion needed before a final conclusion could be reached about the factors that

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determine a pendulum's period of swing. But a small but significant gain had been made in the students' understanding of the need to control all but the experimental variable and in their ability to engage in one of the genres of scientific discourse. Discussing the event later, Jackie agreed that my intervention on this occasion had been helpful.

Science - or Entertainment?

Following the experiments on pendulums, the students worked in groups on topics of their own choosing under the umbrella theme of time. The task for each group was to carry out the appropriate research to answer their chosen question and to prepare to make a presentation on it to the rest of the class. Our hope was that the topics they chose would involve them in both empirical and library-based research. We also hoped that the presentations would include demonstration, for example of model clocks or other timing mechanisms, diagrammatic representations, charts or graphs, as well as written texts.

Over the next two weeks, there were regular reporting sessions at which each group gave an account of what they were working on and how they planned to complete their project. Jackie and I also met with the different groups, usually briefly but on one occasion for fifteen minutes or so, to ensure that they were making satisfactory progress. Very early, however, one group shrouded their project in secrecy, claiming that it would ruin their presentation if they had to give a detailed account of what they planned to do. This group was the first to finish and, one afternoon, after some time for them to make last minute preparations, the rest of the class was called to the library to see their presentation. What transpired took everybody by surprise.

After an opening theme tune, recorded and played back on the VCR, Steven and Priya, dressed in a dark suit and long dress respectively, announced that we were watching W5, a TV station, and that the programme they were about to present would be "An Update on Time". The two presenters then read prepared scripts that informed us about a number of topics to do with time, including Galileo's observations on the chandelier pendulum, time zones, Einstein's theory of relativity, and biological clocks.

Inevitably, because of the limited time allowed for their presentation, none of these topics was dealt with in any great detail, nor were any connections made between them. On the other hand, the texts appeared to have been written for the occasion and not simply copied from reference books and, apart from some stumbling over unfamiliar words, they were quite well read. Next followed a break for commercials. These were parodies of familiar advertisements, which the group had video-recorded in their own homes and were now played back on the TV monitor. Witty and slightly risqué, they were extremely funny and were much appreciated by the 'studio audience'.

However, the culmination to their presentation was even funnier. It took the form of an episode of the quiz programme, *Wheel of Fortune*. Priya, Alicia and Julia were the contestants, all dressed for the occasion in evening wear; Steven was the quiz master; and Nir, wearing a tight black miniskirt, red high-heeled shoes, a blouse filled with an unstable false bosom, white evening gloves to the elbow, and much make-up, was the hostess, Vanna White. Although not speaking a word from beginning to end, s/he stole the show with his coquettish impersonation and had the audience in fits of laughter as he minced around the stage and spun the wheel after each successful answer. Following the format of the original programme, the letters of the hidden word were gradually uncovered as the contestants correctly answered questions about time, based on the information presented in the earlier TV programme. Finally it was revealed to be 'Galileo Galilei'.

There was no doubt: it was a brilliant performance. And Jackie commended the group highly, both for their dramatic skills and for the group collaboration that had gone into the preparation of their presentation. However, after school had ended for the day, she voiced her uneasiness. This was not the sort of presentation she had had in mind and, because these students tended to be the pace-setters in the class, she was concerned about the precedent they had set for the groups that were still to follow. After some discussion, she decided to use the next science lesson to review the presentation in order to talk with the whole class about the purpose of carrying out research and the qualities that made for a good presentation.

Over the weekend, we continued our discussion by e-mail. In a lengthy message, entitled `Post presentation fatigue' (4 April 1992), Jackie further developed her thoughts about an appropriate follow-up.

> I would like to use the presentation [we watched] to discuss how I can pull together some of the ideas they presented that were effective in helping towards their own understanding of the topic they explored. I wonder what the group would think if I made them go through their information presentation again?

I, too, had wondered whether, in the time that the other students spent in completing their projects for presentation, Steven and his friends might be encouraged to try developing some of the ideas that they had touched on in their W5 TV show. However, in the same message, Jackie raised an issue which I felt might, in the longer term, be even more important in redirecting the energy and enthusiasm which her 'open-ended' approach to science had generated. I had recently visited another research site where students at the same age-level were using a large number of networked computers to write notes on the science topics they had chosen to investigate and to comment on the notes written by other class members. This was the Computer Supported Intentional Learning Environment (CSILE) Project, directed by my colleagues Carl Bereiter and Marlene Scardamalia. I had been very impressed by the scientifically sophisticated and focused quality of the thinking that many of the students' written notes and comments revealed and by the ability to sustain the discourse over several turns that was demonstrated in at least some of their exchanges. I had mentioned my visit to Jackie and had passed on to her one of the researchers' papers, entitled 'Text-based and knowledge-based questioning by children' (Scardamalia and Bereiter, 1990). We had already had some discussion of this paper and so I was pleased when Jackie made the connection between what she had been reading and the problems raised by the way in which Steven and his friends had interpreted the purpose of their presentation. She asked: "How do we as the facilitators for the class make a judgment call on what constitutes good questions?"

In responding to Jackie's message, I tried to further strengthen the connection that I thought she was making.

G: There are a number of questions [in your message], some short-term, some longer-term. Let me start with my reactions to the Thursday presentation. There is no doubt they invested a lot of energy and enthusiasm in it - which is a good thing. However, one might argue that the energy was misplaced. They ended up being more concerned about their presentation as a dramatic entertainment than as a sharing of what they had come to understand as a result of trying to answer questions about time that were really important to them. I think that would be a correct evaluation from the point of view of our ideal of intentional learning on the theme of time, but it may be inappropriate at this stage in the development of this class. The sort of commitment to learning and the development of one's own understanding as a worthwhile goal in its own right does not emerge fully developed in one step. What previous experiences have they had that would support such a development, and what models have they to emulate? Do they even understand what it is we are setting as a goal for them? I suppose what I am saying is that one should not place the full responsibility on them for having failed to take up the opportunity that we can see they had ....

In the longer term, their choice of form of presentation raises some really significant questions. What sort of classroom climate might be required for students to see the development of their own understanding being a more important goal (or at least as important a goal) as putting on a good entertainment? Are the two incompatible, or is it a matter of each having its own appropriate time and place? One of the positive features of their presentation was that they had obviously successfully worked together towards their common goal. How can such willing and enthusiastic collaboration be harnessed to 'academic' as well as to 'social' goals? Do they need to be given more guidance to set appropriate goals for a presentation? Are there clear criteria for a 'good' presentation? Who is responsible for defining them - just the teacher, or teacher and students together? But, in a way, this is putting the cart before the horse. Before there can be a good presentation, there must be something worthwhile to present, and helping them to discover what that means seems to be a priority.

J: "How do we as the facilitators for the class make a judgement call on what constitutes "good questions?"

G: "This is a really important question, but it may be one that we need to address WITH the students rather than FOR them. Perhaps, at the end of this unit on time, you might have a preliminary discussion on this. Then, as you are planning to start the next unit, they might be invited to write down questions in advance of starting the unit and make these the basis of a further class discussion. What is a good question will probably vary from one individual to another, depending on their interests and how much they already know; but it may be possible to work towards some common principles.'

Feeling that I had posed enough questions - good or otherwise - I let the matter rest there, and went on to respond to other topics that Jackie had raised. However, in concluding my message, I returned to some of these issues:

> I realize there is a thread running through all my reactions and comments. It is the problem of how to create the conditions for students to take increasing responsibility for their own learning. My hunch is that we tend to be so aware of what they cannot do that we end up doing the difficult things for them, rather than supporting them as they try to find solutions for themselves. The crucial thing is to know how much and what sort of support they need. And there is probably no answer to be found in advance of trying.

The next time we talked was just before the planned review of the first presentation. Jackie asked whether I would join in the discussion, and I agreed. For the first thirty minutes or so, however, I just listened, as Jackie led the class to review the appropriate balance between drama and information and, after reviewing a segment of the W5 episode, to consider how far the information that was included in the presentation had answered the questions that the group had initially chosen to address. At this point, hoping to nudge the discussion in the direction of a more metacognitive type of reflection, I decided to pose what I thought would be a 'good' question. "What's the point of getting information?" I asked.

Quite a number of suggestions were forthcoming, ranging from the functional (to be able to build a clock), through the interactional (to be able to understand if somebody else was talking about the topic), to what I can only call the desire to impress others. However, it was clear from the way in which I accepted and repeated or rephrased their suggestions that I myself had another answer in mind, and one which nobody had yet succeeded in guessing. What it was became clear when I summarized the four main categories of reasons for acquiring information. Three of these were the ones that I have just mentioned, but it was the fourth that I was obviously angling for: "information for understanding, because that's something that you really care about."

Even as I pressed the students for their suggestions and then rephrased them in my own words, I already realised that I was killing any interest they might have originally had in exploring the question in the light of their own experience. Against all my intentions, I was falling into the familiar pattern of what Tharp and Gallimore (1988) call the 'recitation lesson', and I found I could not stop myself. So much for my presumptuous desire to model how "to create the conditions for students to take increasing responsibility for their own learning"! It was a salutary experience.

'Not surprisingly, this 'discussion' did little to change the course on which the remaining presentations were set. It would take more than allowing the students to choose their own topics to modify their understanding of scientific research as conducted in school, which they saw as an exercise in searching for information in reference books and re-presenting it with a garnish of unrelated entertainment. However, there was one pleasing surprise in store. All five members of the original group, working in pairs or alone, prepared a further presentation, in which they developed a part of the content of their original script. Nir's explanation of the organization of time zones was particularly satisfying.

One afternoon, at the end of school, he had asked me to help him figure out a puzzle he had. If, at a spot just east of the international date line, it's five minutes past midnight on the 13th April, and at the same moment it is already 6 a.m. in Canada, midday in Europe and almost midnight in Asia - all on the 13th April - how does it ever get to be the 14th April anywhere?. We struggled with this problem for quite a while, marking points on a circular table to represent places on the earth's surface and taking it in turns to represent the sun. Eventually, we worked out that the best way to think about it was by adding one day to the date each time one's location on the earth's surface faced the sun. However, this still left unresolved the problem of how at midday today, it could already be tomorrow at other places on the earth's surface. Nir went off to see if he could find something to read that would help him solve this problem.

When it came to his presentation, it was obvious that he had succeeded. First he demonstrated how a sundial works, shining a flashlamp (the sun) from a position several feet above the floor towards a circular piece of wood (the earth) lying flat on the floor, which had a pointer projecting at an angle of 45 degrees from the centre, representing the location of Toronto. As Nir turned the earth anti-clockwise, the sun's light on the pointer cast a shadow which, as it moved round the circumference of the circle, traversed the hours from 6 a.m. to 6 p.m., which were marked by radii spanning an arc of 180 degrees. Here I recognized an imaginative extension of the solution we had arrived at to the problem we had been struggling with a few days earlier. However, as he went on to explain the difference in time between places in different time zones, he made use of an even more effective demonstration.

For this, Nir had stuck two miniature sun dials onto an actual globe, one at the location of Toronto and the other at Greenwich. With the room darkened, and using the same flashlamp held several feet away from the globe and at a height appropriate to be `over' the equator, he demonstrated how, when the sun was due south of Greenwich, the sundial in Toronto showed 7 a.m. and when it was due south of Toronto, the time was already 5 p.m. in Greenwich. With these visual aids and his accompanying explanation, Nir enabled many people in his audience, including his teacher, to understand these difficult concepts more clearly than they ever had before. And in so doing, he also provided convincing evidence of the importance of caring about the question that motivates the acquisition of information.

Writing about the creation of opportunities for students to develop a real understanding of science, Bettencourt (1991) states:

> Understanding starts with a question, not any question but a real question ... Said in another way, a real question expresses a desire to know. This desire is what moves the questioner to pursue the question until an adequate answer has been found (i.e. made). Desiring to know opens ourselves to experiencing what is new as new and the already known as renewed under new aspects.

The question that Nir had started with had been a *real* question for him, and one that he had been willing to grapple with until he had succeeded in constructing an answer. And because, in so doing, he had significantly extended his own understanding, he was now able to communicate his understanding to others in a way that was both informative *and* entertaining.

Working in the Zone of Proximal Development

Looking back over the various episodes that I have just described - and at the many others I could have selected - they all seem to pose variants of the same question: How, as a teacher, can one most effectively support another's learning? Or, to put it differently, when and how should one intervene? And, as I hope my examples have illustrated, this question applies just as crucially whether the learner is a grade six student, a classroom teacher, or a teacher of teachers.

From the perspective of activity theory being adopted here, the issue can best be thought of as one of interpreting, in practice, the insights about the learning-teaching relationship offered by Vygotsky's (1978) seminal account of the zone of proximal development. Although there has been much recent debate about exactly how his ideas should be interpreted,[3] there seems to be substantial agreement about the basic principles, which can be separated into three components (Wells, 1992). First, the teacher's responsibility is to select broad topics for study that are culturally significant and intellectually challenging and to encourage the learners to choose an aspect of the topic for investi-gation that they personally find interesting. Of course, this step may not be necessary if the learner spontaneously initiates the interaction by posing a question of his or her own. And this is very often the case outside the classroom, where so many problems and puzzles arise in the course of everyday life. Whatever the originating incident, however, what is important is that the learner should 'own' the problem and have a personal interest in constructing a solution to it.

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[3] At the time of the meetings with Jackie from which I have quoted above, there was a lively debate in progress on precisely these issues, on the xlchc/ e-mail network organized by Michael Cole at UCSD. It lasted for more than a month and ran to well over a hundred pages of computer print-out. I have benefited enormously, in writing this paper, from the variety of views that were expressed during the course of that discussion.

Then, while the learner engages with the problem, the teacher's next responsibility is to provide encouragement and the necessary time and resources, and to observe how the learner responds. From watching and listening, the teacher is able to judge the limits of the learner's ability to solve the problem unaided and thus to know how best to fulfill the third responsibility, which is to join in the activity and to provide the sort of assistance that enables the learner to succeed in doing with help what he or she could not manage alone. Thus, by creating inviting and challenging situations and then engaging with the learner in making sense of the topic selected and in solving the problems that are encountered, the teacher aims to enable the learner both to complete the task in hand and, at the same time, to appropriate the relevant concepts and procedures that are currently within his or her ZPD from participating in their joint enactment.

Stated in such abstract terms, the teacher's task sounds relatively straightforward. However, in practice, this rarely proves to be the case, and success depends on a constant monitoring of both the macro and the micro levels of the teacher's interactions with the learner(s). First, there is the constant temptation to impose one's own agenda instead of allowing the learner to define the problem to be solved. And even if one deliberately avoids directly imposing one's own ideas, the same result may be indirectly achieved by `appropriating' the learner's question or suggestion and recruiting it, or even distorting it, so that it functions as a component in one's own (ideal) scenario. As Newman et al. (1989) convincingly argue, this is sometimes an effective strategy. However, if the teacher's intervention is always of this kind, it functions as just another form of cultural imposition - all the more insidious in that, while appearing to value the learner's contributions it effectively treats them as inferior to the teacher's superior wisdom, thus perpetuating the learner's state of dependency on other people's expertise.

Of course the problem is that the teacher quite naturally wants to `empower' the learner by ensuring that she or he encounters, and has the opportunity to appropriate, the knowledge and skills that the teacher judges to be most valuable. It is difficult, therefore, under the relentless pressure of time, to allow the learner to follow what seems to be an unlikely path or even one that one knows to be a dead end. Sometimes, indeed, it may well be in everybody's interests for the teacher to indicate clearly the direction to follow and perhaps even to spare the learner the journey by announcing the conclusion. Yet, as Schön (1987) and Duckworth (1987) both argue, from their different perspectives, there is no more effective way of learning than by making an error and then reflecting on the event to discover what went wrong and searching for a way to do better. The solution to the problem, therefore, seems to be to give just as much attention to the creation of a learning climate of exploration and reflection as one gives to the choice of the problems to be addressed and to the correctness of the routes to be taken towards finding solutions.

Once the learner is productively engaged in an activity, there is a similar problem, at the micro level, of knowing what sort of assistance to provide. Judgment is constantly called for in deciding whether to leave an individual or group to struggle on their own or to offer assistance. If the latter, a further judgment is required to decide whether to provide support by encouraging reflection, asking probing questions, eliciting alternative strategies and so on, or whether to give substantive input, by demonstrating a skill, providing a necessary item of information, or suggesting a course of action to follow.

When working with a group or a whole class, the problem is further compounded by the certain knowledge that the choice one makes may be effective for some but it will inevitably be less so for others. As Judith

Newman, quoting Elbow (1973) points out, in her reflections on teaching teachers, "You're always right and you're always wrong" (1991, p.177). There are no foolproof, universal rules in this matter. Always, in choosing the best strategy, it depends: on the individuals involved, their level of confidence, their familiarity with the task, and the immediately preceding context, in short, upon the nature of the zone of proximal development that has been created between the teacher and the particular learner(s) in the context of the task in hand. Like the intersubjectivity which is the prerequisite for any meaningful interaction, the most effective way of working in the zone of proximal development is not established once and for all at the beginning of an encounter, but has to be constantly monitored and negotiated as the encounter proceeds.

Like many teachers, I started my career by being too directive, believing - without reflection - that I knew best what my students needed to know. Lecturing from well-prepared notes and allowing discussion only of what I considered relevant issues, I shepherded my students along my predetermined tracks. Later, persuaded by the arguments of the constructivists and by the evidence of the self-motivated achievements of preschoolers learning their first language, I swung to the other extreme, refusing on principle to provide firm direction for fear of interfering with the students' own independent learning. Or at least that is what I claimed to do, although in reality my practice was more like that of the teachers studied by Edwards and Mercer (1987), who believed they were encouraging discovery learning but who nevertheless, and not too subtly, ensured that their students 'discovered' what they, the teachers, believed they should know.

As the episodes discussed in the earlier part of this paper demonstrate all too clearly, I am still frequently impaled on the horns of this particular dilemma. However, I believe I have made progress in that I am now conscious of being in this uncomfortable position. Furthermore, I also know now that there is no permanent escape. For while it is important not to encourage dependence by taking over and solving the learners' problems for them, it is equally important not to hold back when input of some kind is needed. Through observation and reflection, both in and after the event, one can get better at deciding which of these alternatives - or yet others - is the most appropriate in different situations. But, even with this knowledge, the only hope of success lies in trying constantly to be sensitive to the uniqueness of each particular situation.

When Science Comes Alive

At this point, no doubt, I should attempt to evaluate the balance of success and failure in my most recent collaborative project with Jackie. However, rather than review the evidence yet again, I will continue the narrative up to the present, allowing the events themselves to provide a judgment.

The choice of topic for the final science unit of the year was the result of a happy coincidence. Jackie had already decided to choose a topic in the life-sciences that would enable her to place a greater emphasis on observation, when she learned that the School Board would make available to any teacher who was interested a brood of newly-hatched Painted Lady caterpillars. This seemed like the ideal solution. Very little preparation would be required and there would be none of the problems of finding a more permanent home at the end of the project that is associated with breeding gerbils or hatching chicks. When they learned the news, the grade six students were also enthusiastic, and there was considerable excitement when they saw the brown paper bag in which the brood of tiny caterpillars and a container of food for them had been delivered.

In addition to giving her students the opportunity to develop skills of observation, Jackie also intended to use the study of the cycle of metamorphosis to encourage the students to generate their own questions and, where possible, to attempt to answer them on the basis of the evidence derived from their observations. She also wanted to promote more focused discussion about the reasons for choosing one answer rather than another. To a considerable degree, all these aims were realized over the next two weeks, though in ways that were certainly not pre-planned.

Once the caterpillars and their food had been distributed - a practical problem that itself gave rise to some useful mathematical discussion - each group of two or three students had a clear plastic cup containing two caterpillars and sufficient of the vegetable paste to feed them throughout the caterpillar stage of the cycle. For the next hour, having chosen and named their own personal caterpillars, the students began to observe them, discussing what they saw and writing entries in their logs.

As I moved around the groups, I was struck by the variability in the acuteness of their observation and in the amount of detail they recorded. In general, the girls seemed to be superior to the boys in this respect. For example, it was a group of girls that first noticed that the caterpillars had two different types of legs, the back ones being used to hold them in place, while the front ones explored the environment apparently in search of food. It was also apparent that the quality of observation depended to a considerable extent on the interpersonal relations within the group. In fact, this had been an issue throughout the year as we had observed early on that group dynamics and group engagement and productivity were intimately related, each supporting - or detracting - from the other. Indeed, although not previously mentioned, the question of how to help the students learn to work cooperatively had been as much a focus of Jackie's inquiry as the more specifically science-related issues that I have selected to comment on in this paper.

By the end of the week, the caterpillars had more than doubled in size and some had already attached themselves by their `tails' to the gauze which covered the containers and had begun to spin their cocoons. At the end of the afternoon, the students gathered together to review their observations and the questions that they wanted to try to answer. These ranged from "How many legs do they have?" "Do they have teeth?", through questions about their age, to "Which are male and which are female?" and "How do they have sex?"

Discussing how to proceed on these questions with Jackie over the weekend, I suggested that it might be useful to spend some time discussing the different kinds of questions they had come up with and the strategies they could use to try to answer them. From the latter point of view, they could be divided, for example, into those that could be answered by observation, those that would require appeal to reference books, and those that could be settled on the basis of what they already knew. In relation to the latter category, I was thinking, in particular, of the question about how caterpillars have sex. I ended my message as follows:

> You remember our earlier discussion about what makes good questions? Perhaps we shall learn something about this by asking the class to look at the questions they have generated from this point of view. I wonder whether they might come up with some more good questions as a result. Another idea that occurs to me is the following. We could ask for possible answers to one or two of the questions, hoping to get a number of incompatible alternatives. Then people could be asked to give their reasons for or against one or other of the alternatives. In this way we might be able to get them involved in the 'discourse of science' what counts as evidence? what conclusions are warranted by the available evidence? how might one find a way of choosing between alternative hypotheses? etc. Do you have any reactions - positive or negative to any of the above?

However, the matter was taken out of our hands. Over the weekend, one of the partially cocooned caterpillars had fallen from the gauze to which it had attached itself. The question now was "Is it dead?" Without any need for adult intervention, a really lively discussion ensued, in which arguments for and against its being dead were advanced, defended and attacked. Alicia, who had originally asked the question, decided to try first aid. After a number of unsuccessful attempts to resecure the cocoon to the gauze with adhesive tape, somebody noticed that the caterpillars themselves produced a sticky substance from their tails and it was suggested that, if the fallen caterpillar were still alive, it might still be able to stick itself to the gauze. So, taking the rigid caterpillar in one hand and the gauze in the other, Alicia held them together for a few minutes. To the amazement of all the onlookers, the tiny creature suddenly began to vibrate and, when tested a few minutes later, it was found to be securely fastened to the gauze again. Over the next few days, Alicia's skills as a 'veterinarian' were called upon on a number of occasions after clumsy or quarreling observers had handled the containers too roughly.

There was no doubt that the caterpillars' development had aroused genuine interest and engagement among the majority of this group of twelve-year-olds and the questions continued to multiply. One of these sparked another very intense discussion. While I was with his group, Nir had asked what was happening inside the chrysalis to enable a caterpillar to turn into a butterfly. He had then had the idea of taking two or three of them and dissecting one every two or three days to chart their progress. As this would involve more than just his own chrysalis, I suggested he should raise the suggestion in a class meeting. This was immediately convened and the discussion that followed was remarkable for the seriousness with which the students argued for and against the taking of life in the interests of scientific investigation. After half an hour, in which some students who hardly ever contributed had expressed their point of view with feeling and cogency, the matter was put to the vote. There was a substantial majority against proceeding with the dissection. However it was also agreed that, if the most recently fallen caterpillar failed to reattach itself and, after several days, showed no signs of further development, it could be deemed to be dead and subjected to an autopsy.

The following morning, Nir argued strongly that the unattached chrysalis was indeed dead, as he had tried a variety of tests - including prodding it with a pin - and it had shown no signs of life. Surprisingly, the majority were persuaded and Nir was given permission to proceed with the autopsy, provided that there were other members of the group to record in writing and drawing what was revealed.

The events that now followed had all the drama of television scenes involving open-heart surgery and, indeed, careful arrangements were made so that the event could be captured on videotape. Donning white surgical gloves, Nir approached the chrysalis with scalpel in hand while Alicia held it firmly in the middle of the table. Then, as Nir made the first incision, the tiny creature suddenly began to vibrate quite violently. Surprise and consternation: it was clearly still alive! Nir was immediately told to desist while it was decided what was the right course of action to follow. By now, a large group had gathered round the table, all wanting to make their views heard. "Was it really alive, or was this just the nerves reacting although it was actually dead?" Most believed it was still alive, and the question for them was "Could it still recover if it were treated with care, or would it be more humane to put it out of its pain by killing it immediately?"

Space does not allow me to do justice to the quality of the debate by quoting from it at length. But there is no doubt that, in this and the preceding class discussions, the students had begun to engage in the discourse of science with a seriousness and commitment that far exceeded anything that had occurred earlier in the year. And, in the process, they had begun to change their conception of what it is - or, at least, can be - to do science in school.

Conclusion

What, then, were the reasons for the undoubted changes in the learning and teaching of science that had taken place in Jackie's grade six classroom? The answer to this question must inevitably be somewhat speculative, given the limited nature of the data available. However, I believe a number of factors can be tentatively identified.

First, there is little doubt that the topic itself was a major contributory factor. Living creatures of any kind are inherently fascinating if one takes the trouble to observe them closely (see Wells et al., 1990, for an account of a somewhat similar project with ten-year-olds). Unlike the majority of the questions that had been generated by the topic of time, the questions that were asked on this occasion were more spontaneous and many of them had the advantage of being susceptible to being answered, first-hand, by careful observation with the aid of the magnifying glasses that had been provided. As a result, the students had a greater affective involvement in their inquiries than had been the case with the topics they had studied earlier in the year. And this was further heightened by the introduction of the highly-charged issue of life and death.

A further factor was the increasing maturity that comes with age. One would expect a class to be capable of more at the end of the year than at the beginning. However, it was not age so much as experience that had made the difference in the short space of time between January and June. Despite her uncertainty at the beginning, and the sense of loss of direction that she had felt on occasions along the way, Jackie had radically changed the learning opportunities in her classroom in two important ways. First, the science topics on which the class worked had been presented as open-ended and the students had been consistently encouraged to choose their own questions for investigation on the basis of interest and their apparent feasibility. A few rather unsatisfactory choices had certainly resulted, but these had been made the basis for some important learning on everybody's part about what makes a good question and about the strategies that can be used to find and choose between possible answers. Second, throughout the year, she had worked hard to help the students become both more independent and more reflective. She had also given systematic attention to the development of those attitudes and practices that are necessary for cooperative group activity. The students had thus developed some important resources for engaging in scientific inquiry and these were now mobilized by the fascination of the topic itself.

However, it is unlikely that any of these developments would have taken place - or at least not to the same extent - if Jackie had not herself been engaged in a systematic inquiry into her own practice with respect to the teaching of science. For these sorts of change in practice do not occur unless there is a commitment on the part of the teacher to root change in a determined attempt to see what is happening and to understand the implications of what is seen in the light of her or his simultaneously developing theory. Once started, however, this process is self-fuelling and never-ending.

In attempting to evaluate the success of Jackie's action research, therefore, it is clear that it cannot be measured simply in terms of achievement. As Jackie would, I am sure, be the first to acknowledge, both of herself and of her students, there still remains much to learn and much to change. The more important criterion, therefore, is the amount of progress that has been made. And there, I believe, the evidence speaks for itself.

So, finally, what was my role and what have I learned from this experience? On taking over the grade six class, Jackie would certainly have had to give some thought to the science component of her programme. However, the fact that she decided to approach the problem through action research was probably due to the intervention of our research team at the crucial moment. Although, as mentioned earlier, teaching necessarily involves attending to feedback, it seems that it takes some outside agency, whether an enthusiastic colleague, a university researcher or the requirements of a course assignment, to nudge most teachers into more systematic and reflective inquiry. The availability of somebody to talk to during the course of the inquiry is also something that most teachers find important in helping them to gather momentum. And, as I have argued elsewhere (Wells, forthcoming), the expectation that the inquiry will involve some form of written account, although sometimes resisted initially, has a major role in encouraging what Schön calls reflection about reflection-in-action. As the outside agent, my role in performing these functions was probably quite significant.

In the last few years, my participation in teachers' action research has been largely in the role of visiting 'consultant' or as the teacher of a course in action research in the context of a higher degree. In both these roles, I have had little, if any, direct involvement in the day-to-day events which have been the subject matter of the teachers' inquiries. As a result, I have remained relatively detached from the scene of action and any suggestions I have made have involved no vested interests. On the present occasion, however, the situation has been very different. Because of the commitment to collect and analyze data undertaken when accepting the research grant, I have been much more personally involved and have certainly also had an interest in encouraging change of the kind that I have reported. As a result, I have been made very much aware of the double bind that potentially besets this kind of collaborative research. If the teacher with whom one is working shows no interest in engaging in action research, and one accepts this choice as the teacher's right, there is the risk of having little data of value at the end of the project and a mounting feeling of frustration. If, on the other hand, one uses one's status as a researcher/'expert' to bring about the desired changes, the classroom data may well be excellent, but the teacher is unlikely to have been empowered in the process and so one has to live with the knowledge of having betrayed one's principles.

Fortunately, this has not been my predicament in working with Jackie, for she has been a willing and enthusiastic collaborator. Furthermore, she has helped me to recognize more fully than I did before that, as a teacher-educator in such a collaborative partnership, I am faced by exactly the same predicaments as the ones I have been trying to help her to recognize and resolve. As I look back over our work together, I feel that, at the macro level, which was discussed earlier, I have, for the most part, been successful in creating with her a zone of proximal development in which my assistance has enabled her to take over new ideas and practices and make them her own. At the more micro level of responding to her immediate concerns, on the other hand, I have learned that I still have a tendency to be too directive, conveying the impression that I expect my suggestions to be followed, despite my protestations to the contrary. This is an important, though not a very comfortable, discovery to have made. But, in tactfully bringing this aspect of my practice out into the open, Jackie has helped me, too, to make progress in my zone of proximal development.

I have also learned a great deal both from and with Jackie about the learning and teaching of science, and about the things that are important to grade six students - or at least to Nir, Alicia, Wayne, Priya, Andrew and the other children that I have come to know during the last six months. And perhaps this is the most important part of the experience for me - to have relearned that, when it comes to the practice of teaching, every classroom and every learner is unique. There is therefore no way of specifying in advance what will be the most effective way of helping a particular learner. Theory and general principles, although powerful, can only take one so far, since, by their very nature, they cannot predict what is particular and unique. Yet, in the last resort, that is precisely what teaching at any level demands: the ability to mediate between the resources of the culture and the needs of particular individuals. And how, in detail, to do this cannot be preplanned, for the zone of proximal development in which the teacher works with each learner is created by *both* the participants, in the situation, as they construct meaning together.

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Resumen. El autor detalle la colaboración por un año con una maestra quién deseaba mejorar la enseñanza de ciencia a la clase sexta. En este caso de investigación en acción, el autor como especialista no quiso dictarle a la maestra que hacer como mejorar la enseñanza directamente. En cambio el trataba de ser un colega interesado en ayudarle observar, analizar y mejorar su enseñanza por su misma. En esta empresa cooperativa ambos participantes profesionales enfocaron en la zona de desarollo próximo, como mejorar lo que hacían en el aquí y ahora. Se discuten los problemas y resultados.

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Book Review

Rousing minds to life. Teaching, learning, and schooling in social context. Roland G. Tharp and Ronald Gallimore. New York: Cambridge University Press, 1989, 317 pp. ISBN 0-521-36234-2.

(First published 1989, reprinted 1990, first paperback edition 1991).

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In the introduction to Rousing minds, Tharp and Gallimore lay the foundation for their examination of an issue which is currently occupying a great deal of time and resources of reform-minded educators. Namely, why are schools ineffective, and why hasn't school reform worked? In framing the book around this issue, the book is very timely indeed. After presenting the reader with this larger context for the book, however, Tharp and Gallimore introduce the more specific goal of the volume: "In the pages to follow, we offer a science and discipline to address the problem. It is a unified theory and practice of teaching, literacy, schooling, and education, distinguished by its roots in developmental, behavioral, and anthropological sciences.(p. 5)" Further, "It is our purpose to unite behavioral science with new-Vygotskianism and thereby illuminate the full issue of teaching, schooling, and literacy development.(p. 8)" By any account, this is a big promise. Does the manuscript deliver?

The first half of the book lays out a theoretical discussion of teaching, learning, and literacy from a neo-Vygotskian framework. The second half of the book grounds the theory in long-term work in the Kamehameha Elementary Education Program (KEEP) in Hawaii, with which the authors were heavily involved.

What is the basis for the "science and discipline" Tharp and Gallimore promise? "It is an emergent contextualist and interactionist view of human development that draws from the achievements of 20th-century English-speaking social science and from what we refer to as "neo-Vygotskianism..." At its most elementary level, the neo-Vygotskian view proposes that higher-order functions develop out of social interaction with more competent others. A major focus of Tharp and Gallimore's treatment of this topic can be seen as the explication of a theory of assisted performance with an emphasis on school contexts. In this framework, "real" teaching is defined as assisting performance through the zone of proximal development at points in the learner's zone which require assistance.

In laying out this theory of assisted performance, Tharp and Gallimore provide an important service, namely providing a way of integrating neo-Vygotskian theory with elements of the long-standing tradition of behavioral psychology and the more recent emphasis on cognitive science. The six means of assistance include modeling, contingency management, feeding-back, instructing, questioning, and cognitive structuring. This framework provides a means to integrate the tools described in the long-standing empirical tradition of the behaviorists, which become the means of assistance in teaching/ learning encounters. Moreover, their framework provides a way of integrating contributions of more cognitively-oriented work. Although cognitive science has been useful in describing the "what" in higher-order thinking (metacognition, planning, self-monitoring, etc.), it has never been particularly helpful in accounting for how these are acquired. By emphasizing the social and interactional roots of cognition and learning, Tharp and Gallimore's framework addresses a dimension badly neglected in traditional psychological accounts of learning especially in applied contexts such as schools.

In the course of developing their theory of assisted performance, Tharp and Gallimore outline a "triadic" model of assistance which has major implications for school reform. With regard to assisted performance, ...the first responsibility of A is to assist B to assist C. A is to assist the behavior of B so that B correctly assists C. This triadic analysis offers a radical solution to supervision through bureaucracy. No school supervisor should merely direct and evaluate...every supervisor should assist the supervisee to assist. In the triadic school culture, every supervisor's target of concern is two positions away, because each individual in the culture is assisting others. (p. 84)

This provides a useful way of conceptualizing school reform, since it moves the commonly used level of analysis from the teacher in isolation, or even the teacher-student dyad, to an interlocked "...triadic analysis...the smallest unit appropriate to a study of the social organization of assistance." (p. 83) The implications of this analysis is something school restructuring advocates would be well advised to consider.

In general, the theoretical discussion in the first half of the book is very well done. Many treatments of new-Vygotskian theory and its offshoots often fall short in one of two ways. They can be overly complex, such as in arcane discussions of the levels of analysis of activity theory, for example, thus rendering the concepts out of reach for practitioners in everyday teaching and learning settings. Or, they can be overly simplified by treating single isolated elements of Vygotsky's theory as discrete concepts, separate from a larger theoretical framework as with the ZOPD. Fortunately, the first half of the book provides a nice middle ground, including a strong theoretical discussion not couched unnecessarily in inaccessible jargon.

In the second half of the book, Tharp and Gallimore attempt to illustrate the applied dimension of the theory through examples from a long, programmatic research program based on the KEEP project. Since the characteristics of the KEEP students emulate in many ways those of mainland ethnic and/or racial minority students (poverty, low school achievement, interactional and discourse styles divergent from middle class standards), this aspect of the book is of special concern to educators addressing these issues in the US. Sooner or later, all who work in this area must come to grips with their own explanation for poor school achievement and diminished educational outcomes. The easiest and most entrenched explanations, focused on linguistically or culturally based deficits, are clearly inadequate in light of a large and growing literature on the hidden competencies of students which emerge given the appropriate organization of the context.

The explanation suggested by Tharp and Gallimore is that for a variety of reasons, some minority students may not have access to the same type or quantity of high level meaning-oriented interactions around literate activities typically found to be compatible with those in school. Or, conversely, the experiences they do have do not easily transfer to traditional school settings. These circumstances are seen to result largely from features of the family's ecocultural niche, not inherent in the culture nor a result of parental apathy or disinterest nor related to students' diminished cognitive competence. Importantly, as the KEEP work and other research cited suggests, when conditions are organized to take into account student existing knowledge, interests, and competence, they are every bit as engaged and motivated as high achieving students. Perhaps this part of the book will help to nail the coffin on those theories and practices which continue to focus on student and family deficits as the primary explanation for alarmingly high school failure among many minority children. As Tharp and Gallimore correctly point out,

> ...teachers usually blame families and the culture for failure to provide adequate language development at home, and they castigate such families for their lack of interactions that would prepare verbal-conceptual thinking. The irony would be laughable, were it not tragic: The schools themselves have adopted the interactional patterns so often attributed to disadvantaged homes. (p. 100)

An especially appealing aspect of the second half of the book is that the theories are grounded in everyday classroom settings.

The case studies, transcripts, and field notes help the reader to get a sense of how the ideas look in practice. For example, the reader actually struggles along with Grace, as she tries to move from a recitation to a more responsive teaching style. For school reformers whose vision includes paradigmatic shifts, this part of the book is essential. Many reforms include fundamental shifts in paradigms with little or no thought to the complexity of the change process. This book provides a glimpse of the tremendous amount of effort and resources, not to mention painful self-reflection, which are required to implement and sustain changes in one's world views about educational practice. As Tharp and Gallimore point out, the typical one-shot or short-term inservice training is entirely inadequate for any meaningful change.

What are the shortcomings of the book? Left unaddressed or taken for granted is the WHAT regarding how schools do their jobs. What is the content? Is the task before us to find better ways to meet currently defined goals, or to rethink educational goals altogether?

Also, there is a tension between the notion of intersubjectivity (including participant's understanding of the meaning of a task or defining the goals of a task) which is negotiated in the course of joint activity and the more directive assistance which might be required to meet teacher or school-defined goals. Unlike parents in natal interactional settings, teachers and schools have a larger agenda which requires attention. Those who argue for a more complete laissez-faire organization for teaching/learning activity settings may be a bit uncomfortable with the notion of providing directive assistance in the service of school- or teacher-defined goals. Those who favor a more structured approach to teaching or who advocate a "back to basics" orientation might be uncomfortable with the notion of responsivity which denigrates pre-specified (and thus "packageable") teaching practices.

In short, the book may contain more theory than some practitioners would like, and not as much detail as the researcher would prefer. However, this says more about the professional roles involved than the book itself. Overall, this book represents a major contribution to the field, and is a "must" for the serious student of teaching/learning. One would have to agree that the authors have delivered on their initial promise as described at the beginning of the review. There is something here for everyone, including the teacher, the researcher, the student interested in teaching, learning, language, and literacy. Interestingly, it shows the power of natal teaching and the "pedagogy of everyday life." Perhaps, after all our efforts toward the development of elaborate and complex theories of teaching and learning, the most powerful model of all has been under our noses waiting to be appropriated and elaborated all this time.

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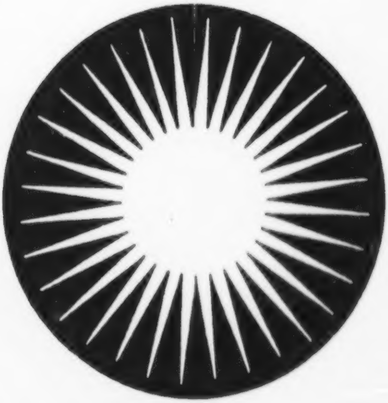

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The Editor welcomes submission of manuscripts with a focus on accelerating and improving teaching and learning, particularly with classroom suggestion or Suggestopedia. This journal publishes articles on: critical reviews, theoretical analyses, speculative papers, case studies, quasi-experimental studies, as well as reports of controlled studies of empirical research.

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REFERENCES should follow APA style according to the latest American Psychological Association Style Manual. See any issue of this Journal for examples. In the body of the text, the work of other authors should be referred to by name and publication date in parentheses as follows, "Xia and Alexander (1987) reported..." In the references the referred-to articles should be listed fully in alphabetical order by author(s), title and publication source information as follows, "Voci-Reed, E. (1987). Teaching adult learners using accelerated learning. Journal of the Society for Accelerative Learning and Teaching, 12 (1&2), 85-94." Footnotes should be used rarely, if at all.

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The 636% Solution Paradigm: A Statistical Evaluation of the Extraordinary Effectiveness of Lynn Dhority's US Army Accelerated Learning German Class

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and

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University of Massachusetts - Boston

Abstract. The first author performed statistical analyses of pretest/ posttest data collected but unanalyzed by the second author in teaching German with accelerated learning techniques. Compared with previous control groups taught conventionally by the same teacher, the experimental class achieved posttest scores more than double those of the controls, and with one-third the class time for instruction. These outstanding results merit calling this class a model or paradigm of accelerative learning.

Introduction. One of the most notable documentations of the effects of an accelerative learning class was published in 1984 by Lynn Dhority, a master German professor who studied with Georgi Lozanov, Stephen Krashen, James Asher and Tracy Terrell. His class represented increases in training effectiveness of 636% to 739% compared to three previous control group classes. Expanded interest in this highly successful teaching approach has resulted in the recent second edition published by Gordon and Breach (Dhority, 1991) which describes the principles of conducting enhanced learning classes, and describes in detail the pilot program in training US Army personnel in introductory German language skills. A thorough review of this book was recently published in the SALT Journal (Schuster, 1991).

Dhority's description of the pilot project and the documentation of the results represent the essence of the effectiveness so often observed in accelerated learning classes. In fact, Dhority has supplied enough detail, description and data that we have a clear picture of the class and its results. So clear is this picture that Dhority's study can serve as a paradigm for the concept of accelerative learning. (A paradigm is a reproducible model experiment or operation which exemplifies the principles of a system of thought or assertion.) Thomas Kuhn, in his landmark book, *The Structure of Scientific Revolutions* (1962, 1970), is said by John Casti to have discovered that our minds work "... within a distinctive paradigm, a kind of intellectual gestalt that colors the way Nature is perceived ... a framework of suppositions about what constitutes a problem, a solution, and a method." (Casti, 1989) Whatever the scientific field, the general discussion of new ideas is accompanied by a concrete action which vividly demonstrates the breakthrough in thinking. The clarity of this event is demonstrated through precise measurement which produces evidential data. Dhority's study is clearly one which can be cited as a premiere example of accelerated learning, and is therefore, the Accelerated Learning (AL) paradigm.

Characteristics of the Accelerated Learning Paradigm

Master Teacher. Dhority was already a successful and experienced German teacher, yet he wanted personal satisfaction in addition to the knowledge, skills and results already attained. He internalized/ created/ owned/ mastered his curriculum.

Trust in AL in spite of doubts. Dhority had ambivalent feelings and thoughts about a possible contradiction between the rigid authoritarian military climate and the principles of accelerated learning, yet as an objective experimenter he allowed for the possibility of the principles to work under antithetical conditions.

Adaptation of suggestion principles to class. Dhority understood that rapport and communication were the points of connection for trust and acceptance, and that the instructor's authoritative presence and beneficial learning climate must be established.

Thorough preparation. Professional training and experience in teaching AL classes are required before documenting experimentation. Materials for the course were completely developed, including peripherals, music, games, songs, activities, scripts.

Measurable results. Clear objectives allowed for baseline pretests and post-course measures for outcomes. Data were made available for independent statistical analysis as a quasi-experimental design for possible inclusion in later meta-analyses.

Results expressed in time and achievement level. Time as an investment resource is considered, as well as achievement level for determination of the size of pragmatic efficiency/ effectiveness increases.

Statistical analysis and errata. Dhority's Tables 3 and 4 should be replaced by the current tables. The experimental data set consists of material from 11 subjects, not twelve as previously reported, and some percentages have been recomputed. The original raw data were reported without statistical testing of differences between groups. This article provides revision of the data in the tables and supplies statistical tests of significance of differences between groups and effect sizes for an intact groups quasi-experimental design.

The revised Table 3 (Dhority, 1991, p. 166) is presented here, and shows highly significant differences favoring AL teaching. The significance of difference in experimental vs. control proportions was tested by computing binomial expansions corrected for continuity and used the one-tailed alternative hypothesis as if the subjects (samples) had been randomly assigned.

Table 3. Proportions of Students Achieving Level One or Better

Test	Regular	Experimental
	N = 34	N = 11
DLPT Listening	N = 10 (29%)	N = 8 (73%)*
DLPT Reading	N = 10 (29%)	N = 7 (64%)**

* $z = 3.54$, $p < .001$; ** $z = 2.81$, $p < .002$

The distributions and relevant statistics for students in the regular (control) and experimental classes on the DLPT Listening and Reading tests are given in Tables 4 and 5. The DLPT levels of achievement were coded as follows: 0=0, 0+=.5, 1=1, 1+=1.5, 2=2, >2=2.5 Statistical t-tests of differences between group averages revealed significantly higher achievement for the AL class in both listening and reading of German. AL students achieved at more than double the levels of control students. (Dhority, 1991, p. 163)

Table 4. Comparison of pilot experimental class to previous classes on DLPT scores

DLPT Listening Test

	Regular		Experimental	
Score	n	%	n	%
0	19	56	1	9
0+	5	15	2	18
1	6	18	5	45
1+	1	3	1	9
2	2	6	2	18
2+ & above	1	3	0	0

	Regular	Experimental
Average level	0.485	1.045
Standard dev.	0.68	0.58
Effect size		0.823 SD

Posttest t-test = 2.409, df = 43, $p < .025$

The significance of students achieving DLPT level 0+ or better was tested using the binomial expansion corrected for continuity as if subjects had been randomly assigned. For Listening, $z = 3.44$, $p< .001$ one-tailed, and for Reading, $z = 3.06$, $p < .002$, one-tailed. All but one AL student (91%) achieved level 0+, whereas fewer than 50% of control students met this halfway mark of the class objective.

Table 5. Comparison of pilot experimental class to previous classes on DLPT scores

DLPT Reading Test

	Regular		Experimental	
Score	n	%	n	%
0	20	59	1	9
0+	4	12	3	27
1	7	21	3	27
1+	1	3	1	9
2	0	0	2	18
2+ & above	2	6	1	9

	Regular	Experimental
Average	0.456	1.136
Standard dev.	0.68	0.74
Effect size		1.00 SD

Posttest t-test = 2.758, df = 43, p < .005

Effectiveness of Creatively Enhanced Instruction.

Regular Control	Experimental Pilot
12 weeks	3.5 weeks
60 days	18 days
360 hours	108 hours

Practical results were a six- to seven-fold increase in criterion achievement because more than two and one-half times the results were produced in less than one-third the time compared to the conventional teaching procedures in the control condition. Comprehensive content was condensed, integrated, accelerated and presented using a creatively enhanced instruction approach in a carefully prepared environment. The increases of 636% in reading and 739% in listening effectiveness were computed by dividing the achievement per hour of the control group into the same measure for the experimental group. See Table 3: 64%/108 hours reading and 73%/108 hours listening experimental divided by 29%/360 control hours resulted in ratios of effectiveness of 1:7.356 for reading and 1:8.39 for listening. These values were converted to percentages and 100% was subtracted to indicate the increase in effectiveness rather than the ratio.

Although the subjects were not randomly assigned to the groups as in true experimental design, the quasi-experimental pilot group design is common. The students in the experimental group did not choose or volunteer to take this special class.

Impact. Major savings were realized from instructor time and expenses, *per diem* expenses for students/trainees, time away from job and substitute costs. These costs were cut from one-third to one half of previous costs.

Advantages were produced in student attraction to course content (rather than resisting, putting up with, tolerating, enduring to the end, boredom, anxiety, efforting, tension and other negative physiologic life-long conditioning). High and efficient application levels on the job, improvement of retention and skill after the course finishes produce high satisfaction from both students and supervisors. The course participants have been positively reconditioned for better future expectation of learning experiences.

Post-script. Having produced these outstanding results, the Army encouraged Dhority to bid on future course offerings, and he submitted a proposal and bid. Incredibly, a requirement of previous demonstration of effectiveness was not required, and a lower bidder was awarded the training who subsequently failed to fulfill the contract. Dhority did not rebid because of allocation of time and effort to other activities.

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*** *** ***

Resumen. El primer autor realizó análises estadísticos de data colectada sino no analizada por el segundo autor en el enseñar aleman con técnicas de aprendizaje acelerado. Comparada con previos grupos de controlo enseñados convencionalmente por el mismo maestro, la clase experimental ganó puntuaciones finales más de doble las de los controlos, y con un tercero del tiempo por instrucción. Estos sobresalientes resultados merecen llamando esta clase un modelo o paradigma del aprendizaje acelerativo.

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A re-examination of North American Adaptations of Suggestopedia

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Abstract. A critical review of the literature involving the Suggestopedic Approach to second language acquisition, as developed by Georgi Lozanov (1982), reveals the vast degree of controversy regarding its effectiveness. A majority of the confounding research, however, may be due to faulty theoretical understanding. Due to misrepresentation and misinterpretation of the original Lozanov thesis, early American adaptations of the Lozanov Method used, almost exclusively, components of the third phase (the pseudo-passive concert) of the method for presentation of new material to students. It is suggested that indeed the pseudo-passive concert phase of the Lozanov Method can be adapted to North American education, but not in order to present new material. Rather, adaptations of the pseudo-passive concert phase may be more effective when used as a method of study and memorization. A controlled study was used to examine this hypothesis. Results showed that students who were exposed to a pseudo-passive concert session achieved higher scores on a test than students who memorized the information using conventional means of study. Researchers involved with accelerated

learning techniques as well as second language teachers may find the theoretical considerations presented herewith beneficial.

*** *** ***

Introduction. During the 1960's Georgi Lozanov, a Bulgarian physician and psychotherapist, researched and applied the theory of suggestion to the learning process at the Institute of Suggestology in Sofia, Bulgaria. Lozanov's purpose was to develop an efficient and effective approach to second language acquisition. Lozanov based his approach on the assumption that emotional, environmental, and psychological variables could be altered to make more effective use of students' ability to learn. His approach eventually became known as the Lozanov Method or Suggestopedia.

Suggestology is defined as the study of the theoretical and practical aspects of suggestion (Lozanov, 1978). In Lozanov's terms suggestion is:

> ...a communicative factor which is expressed in "proposing" that the personality should make its choice... The choice is founded upon the external orchestration of the stimuli which come from outside of or arise within the personality itself, not only within the limited sphere of consciousness but also, simultaneously and to a fuller extent, in various and numerous levels of paraconsciousness. (Lozanov, 1982, p146)

Thus, for Lozanov, suggestion involves presenting someone with a "choice" (an idea, information, etc.) which affects the decision- making process at a sub-conscious level. From this, Lozanov (1978) coined the term Suggestopedia (suggestology + pedagogy) to mean the application of suggestion to education and learning. Lozanov believes that through suggestion we can tap into memory capacity we do not normally use:

> Suggestion in its most positive manifestation and when well-organized can uncover the personality's reserve capacities....the unmanifested, but genetically predetermined capacities operating mainly in the paraconscious and surpassing the normal ones several times over. (Lozanov, 1982, p147)

The Lozanov Method involves many components, all of which can contribute to efficient second language acquisition. Students using the method learn while in two complementary states of consciousness: a wide-awake, alert state and a relaxed but also alert state (Bancroft, 1984). In his report to UNESCO, Lozanov outlines the theory of his system of teaching as an amalgamation of disciplines (Lozanov, 1982). In order to help students attain a relaxed and alert state, Lozanov's method evolved out of previously established disciplines, including raja yoga, autogenic therapy, parapsychology, and Lozanov's own studies on Suggestology.

Students involved in Lozanov's program have to undertake some training in which they apply mental disciplines to gain measurable control over the physical body. Both yoga (specifically breathing exercises) and autogenic training help students attain a relaxed state during which there is alpha brain wave production (Green, & Green, 1977), a necessary component for success using the Lozanov Method.

Lozanov's classes are divided into three distinct but mutually dependent parts known as the "suggestopedic cycle" (Bancroft, 1978). Part one of the cycle includes review of the previous day's material. Part two includes introduction of the new material to be learned using fairly structured, traditional methods of presentation. The third and final part of the cycle is the unique pseudo-passive concert (or session) period used to reinforce and aid in memorization of the new material at an unconscious level. Lozanov originally had called this phase a "séance", but changed his terminology as he quickly realized his connotation was different than the usual negative western definition of this term.

During the pseudo-passive concert, Lozanov would create an environment in which students were more receptive than usual to suggestion. A typical Lozanov class environment during the suggestive (or what Lozanov called the pseudo-passive concert part of the lesson) would include dimmed lights, pleasant room furnishings, comfortable reclining chairs and classical baroque music.

The principles of suggestopedia that are incorporated into the pseudo-passive concert as outlined by Lozanov (1982) are:" (1) joy, absence of tension, and concentrative psychorelaxation; (2) unity of the conscious-paraconscious and integral brain activation; and (3) suggestive relationship on the level of the reserve complex." (p156). Lozanov (1982) rejects a linear approach to learning which he claims is ..."dry logicalized teaching" (p156) which doesn't take into account the emotional aspects of the student. In expanding upon the principles of suggestopedia, Lozanov cites the necessity for students to be allowed to find personal emotional meaning in material being learned (specifically languages). It is these principles then that provide the setting for memorization of the new material at an unconscious level (Bancroft, 1978). The following is a brief summary of the passive part of the pseudo-passive concert as described by Dr. Bancroft who has personally witnessed Lozanov language classes in Bulgaria, and who presently incorporates components of the method into her foreign language teaching at the University of Toronto. Bancroft writes:

> During the pseudo-passive concert, which lasts about one hour, the students relax the vital areas of the body and sit in their reclining chairs in the alternate Savasana posture. They breathe deeply and rhythmically as a group- following the precepts of correct yoga breathing and according to a precise count of eight (two seconds' inhalation; four seconds' breath retention; two seconds exhalation). This rhythm accords with the

> teacher's reading of the language material, and...with the slow-moving (MM60) beat of the baroque music in the background.(p.171)

In North America, it has been the third component of the Lozanov Method (the pseudo-passive concert) to which a majority of attention has been given. Specifically, it is the classical music, rhythmic breathing, relaxation, and visualisation components of the pseudo-passive concert that form the basis of many of the American adaptations, including the "SuperLearning" and Suggestive Accelerative Learning Techniques (S.A.L.T.) methods of teaching. Logically, these components of the Lozanov Method were the "newest" and most unique aspects, attracting the most attention from Westerners.

What early researchers apparently over-looked, however, is the necessary "wholeness" of the Method, including those components already known to be effective such as repetition and relaxation, from which no one part should be considered the "working" component.

Given a specifically ordered blend of the above mentioned components, Lozanov reported that his pupils were able to learn new words and phrases of a foreign language at astounding rates. Inevitably, Lozanov's claims were exploited in the popular press. To date, most researchers have cited data as reported in pop-psych books as being that of Lozanov's: a connction which may not necessarily be valid.

In the late 1960's, a pair of American researchers, Sheila Ostrander and Lynn Shroeder, traveled to Bulgaria to witness the method and to interview Lozanov himself. However, neither of them were able to actually see a foreign language class in vivo at that time. In their second book entitled "SuperLearning", Ostrander and Schroeder (1979) present the Lozanov method in a non-scientific manner. The two authors outline an American adaptation of Lozanov's method based mostly on the "suggestive" or pseudo-passive concert part of the Lozanov Method. Bancroft (1978) concludes "the Ostrander-Schroeder book, almost by definition, does not provide a detailed description of the suggestopedic language class." (p.168)

To date, much of the controversy surrounding the Lozanov method has been centered around proponents' claims of amazing success in speed of acquisition of information. Ostrander and Schroeder (1979) claim that ..."some tests showed people capable of absorbing even 3,000 words [of a new foreign language] per day" (p.35). As well, they reported "this system speeds up learning from five to fifty times, increases retention, (and) requires virtually no effort on the part of the student..."(p.15). However, much of this data is reported without proper citations and no mention of control groups. Furthermore, no research outside of the Eastern block has been able to duplicate or substantiate such claims.

Although not scientifically based, the Ostrander-Schroeder books sparked much interest and research into the Lozanov Method. Findings from research have not been conclusive, however. Some researchers have been more thorough than others, taking time to understand the background theory of the method. Also, some researchers have been able to adapt various parts of the method to North American pedagogical standards, such as 50 minute classes, upright chairs, and larger numbers of students (Lozanov used only 12 students per class). For example, Taylor and Prichard (1976), reported to have found, from their experiments on remedial reading, that after fourteen weeks in the program "75-80 percent of the pupils gained a year or more on the Spache oral and silent reading subtests." (p.169). Other supporting research includes a meta-analysis by Moon (1986) of forty studies using one or more components of Lozanov's method. Moon (1986) reported that "the overall performance of subjects under suggestology was three-quarters of a standard deviation higher than the average performance of subjects under control conditions." (p1). Furthermore, Marcum (1987) conducted a psycholinguistic analysis of the Lozanov Method in light of current theory on the nature of learning, language acquisition, and memory. Marcum concluded that Lozanov's method should achieve better than average results in learning.

Conversely, others report findings that do not support the Lozanov Method. Wagner and Tilney (1983) reported in their study on the effect of "Superlearning Techniques" on vocabulary acquisition that superlearning techniques could not be substantiated. Bush (1986) compared three language instruction methods at the Army Research Institute in

California. He reported that suggestopedia was neither more effective nor resulted in more positive attitudes when compared to the other methods. Thus it is evident why many researchers are reluctant to accept such an "unusual" method of questionable effectiveness, given the paucity of the claims of success and the lack of supporting data from Western researchers.

One possible explanation for the lack of supporting data is that many of the early S.A.L.T. methods of teaching focused on components such as relaxation and classical music, which are taken mainly from the pseudo-passive concert part of Lozanov's method. These components are often integrated into one class with traditional methods for presenting new material such as note taking and black board work. However, Lozanov intended for components of the pseudo-passive concert to be used specifically to enhance the memorization of material that has already been explained, while the presentation (or explanation) of new material is done in the other two parts of the Lozanov Method. It is suggested then, that a majority of the research in the field of accelerated learning techniques has tried to apply some parts of the Lozanov Method to aspects of teaching for which they were never intended (i.e., the presentation of new material as opposed to the memorization of material.)

S.A.L.T. methods of teaching have only partially supported Lozanov's claims. For example, Bordon and Schuster (1976) report a study in which students learned new Spanish words 2 and 1/2 times better with the S.A.L.T. method than controls with a method involving traditional presentation of the material (i.e., without music, pre-relaxation, etc.) However, as with "Superlearning" and other studies, research using S.A.L.T. methods has not been able to replicate all of Lozanov's findings such as students learning up to 3,000 words of a new foreign language per day..

It is suggested that much of the discrepancy in research findings may be explained by examining more closely the methods and theory in question. Also, it is important to note that all of the research that has been carried out in North America on suggestopedia has been aimed at adapting the Lozanov Method to the standard North American classroom and curriculum. Indeed Lozanov's original thesis was organized within the framework of a special month-long intensive course designed specifically to teach Bulgarians Western foreign languages. Although, Lozanov (1982) states that his theory is not restricted to an intensive course, and thus would presumably be adaptable to the standard American 50 minute class, he goes on to emphasize that maintainance of the original organization of the method is paramount for success. Lozanov (1982) states:

> There can be different variants of the suggestopedic foreign language system, from courses with several lessons a week to courses of whole days' "immersion" in the suggestopedic foreign language atmosphere. The leading factor is not the number of lessons but the psychological organization of the process of instruction. (p.159)

Instead of testing Lozanov's method in full however, early Western research such as "Superlearning" concentrated on components, in full or in part, of the third and final part of the four hour Lozanov language class. Furthermore, there is no theoretical background to validate or warrant such proceedings. Lozanov (1982) states that results from the pseudo-passive concert cannot be achieved "if the principles are applied separately " (p156). Lozanov (1982) specifically presents his method as a "whole" concept of learning in which no one part is the key element, and no one factor the working agent:

> The most important thing in our opinion is to do away with mass didactogeny and bring the process of instruction into line with the laws governing the functioning of the brain. (p154)

Bancroft (1978), presents several possible reasons which may help to explain most researchers' ignorance of the necessary "wholeness" of the suggestopedic lesson and which may account for the described discrepancies in research. One obvious barrier to accurate replication of findings is that most Western researchers are unable to read original Soviet psychological reports, so they rely instead upon translations which are often inadequate or difficult to follow. Another problem is the lack of properly controlled research in the Soviet Union. Bancroft (1978) writes: "Soviet publications show, in many instances, a seeming lack of concern for methodology or statistical treatment of data."(p.167).

Therefore, without proper documentation to follow or to consult, Western researchers have had to rely on their own good instincts.

It is suggested that a majority of the research claiming to have tested the Lozanov Method did in fact only test a part (1/3) of the original method. Such an account may explain the lack of supporting evidence for the Lozanov Method.

Lozanov's method was designed for an intensive foreign language program consisting of six weeks, four hours per day, and only one subject: the foreign language to be learned. Without simulating such conditions and using all of the components, we cannot claim to test Lozanov's method in full. It is possible, however, that Lozanov's insight into the application of Suggestology to education be adapted to American classrooms. Research must turn to more realistic adaptations of Lozanov's methodology to North American pedagogical standards. The pseudo-passive concert and its components should no longer be tested as a self-contained method of presentation in itself.

This author contends that the pseudo-passive concert session should be considered as an adjunct to the traditional teaching methods (i.e., as a review technique or method of memorization only.) Traditionally, review and memorization has been given in the form of assigned homework, rote learning exercises and large amounts of reading materials. Some research suggests, however, that a somewhat modified version of the pseudo-passive concert might be used in order to minimize study time and increase memory capacity as well as retention rate.

In this way the pseudo-passive concert is viewed as a method of study as opposed to a method of teaching. The present research will examine use of the essential components of the passive pseudo-passive concert as a method of review and memorization following a traditionally taught class presenting new material.

METHOD

Subjects: Forty (40) male students from two Grade 8 science classes were used in this study. All of the subjects were 11-12 years old and were enrolled at Upper Canada College Prep School, an all-male private school in Toronto, Ontario. Prior to the experiment, parental consent as well as student consent was obtained. All subjects were naive to the experimental design.

Prior to the experiment, a list of student names was used to generate two groups of twenty students each, an experimental group (Group 1), and a control group (Group 2). Each name was coded with a different number from 1-40. Students were randomly assigned to either Group 1 or Group 2 in an alternating fashion with the condition that an equal number of students from each class were placed into each group. Students were debriefed at the end of the second test period.

Materials: For the purposes of the "traditional presentation" of information to both classes, a lesson outline was established prior to the experiment for use by the teacher only. Students used their personal binders, pens, and so on in order to take notes during the 50 minute class. A fact review sheet was constructed prior to the experiment for use by the teacher only. The sheet was based on facts selected from the lesson which the students' teacher deemed important, and on which subjects would be tested later. The review sheet included new terms and definitions from the lesson to be learned by the students. On the review sheet, information was grouped in sets of 3 sentences, and each sentence was read aloud by the instructor with a different intonation or volume. For example:

normal - Atrium of heart - small chambers
loud - Ventricles of heart are larger
soft - Septum - separates ventricles

It is important to note that the differences in voice intonation have no necessary connection to the meaning of the sentences. The contrasting tonalities are used to add variety to the lesson and possibly to keep the rhythmically-breathing students from becoming too relaxed and falling asleep.

The same review sheet was used for review with both Group 1 and Group 2. A copy of the review sheet is presented in Appendix A. Subjects in Group

2 were given several pieces of unmarked lined paper and a pen in order to write down review information.

For the suggestopedic review, a pre-recorded selection of Classical Baroque music (Bach's Brandenburg Variation) was played on a Sony Cassette-corder CFM-140 II. Both Groups were given the traditional lesson in the same classroom, and were in similar rooms during phase 2. The test used for Phase 3 and Phase 4 of the experiment was constructed by the students' teacher. The test included seventeen fill-in-the-blank items. Each subject was given a mark out of 17. A copy of the test is presented in Appendix B.

Procedure: The procedure involved the traditional presentation of material (Phase 1); suggestopedic vs. traditional review of material presented to Group 1 and Group 2 respectively (Phase 2); testing of student recall of lesson material following the review session (Phase 3); and testing of recall after an interval of two weeks (Phase 4).

Phase 1. The first phase of the experiment involved the traditional presentation of the material to be learned. For the purposes of this experiment, the term "traditional presentation" of material includes oral presentation, discussion, and elaboration of new terms and concepts using written information and diagrams as presented on the chalkboard at the front of the class. Students were also encouraged to take notes as usual. This ensured that this first part of the experiment (Phase 1) was true in procedure to a traditional North American Gr. 8 class. The arrangement of the class was also traditional with the teacher standing at the front of the room while students sat in rows of desks facing the front. Students were allowed to, and encouraged to ask questions at several points during the lesson.

The topic of the lesson was "Learning and Learning Research", and was considered part of the normal curriculum and course requirements. Both classes (of 20 students each) were taught one 50 minute lesson each by their usual science teacher. The classes were taught during their normal science class period. Therefore, the experiment did not involve any deviation from the students' usual schedule or routine. A lesson outline was used in teaching the material to ensure that the order, manner, and content of presentation was the same for both classes.

At the end of each class, students were informed by the experimenter of the locale of Phase 2 of the experiment. Exactly half (n=10) of the students from each class were assigned to Group 1 while the other half were assigned to Group 2.

Phase 2. This phase of the experiment consisted of a traditional review of material presented in Phase 1 for subjects in Group 2, and a suggestopedic review of the same material for subjects in Group 1. In order to adhere as closely as possible to the students' daily routine, the review session (Phase 2) was carried out between 2 PM and 3 PM on the afternoon of the science lesson. This time is their usual "Prep" or study period scheduled each day for the students at the school.

Subjects in Group 2 (Control group) were seated at individual desks in a classroom. Each student was provided with several pieces of unmarked lined paper and a pen. Students were instructed to listen attentively to, and to write down the information read aloud to them by the instructor. This was done in a dictation format. The information was read aloud twice through, and was exactly the same as that read to the subjects in Group 1 during the suggestopedic review. The review information was read from the review sheet. Students in Group 2 were asked to study the information carefully in attempts to memorize the information presented. It is felt that the review session was representative of a traditional review procedure for students at the Grade 8 level.

Subjects assigned to Group 1 (the experimental group) were placed in a room separate from, but similar to that of Group 2. However, there were no desks in this room. Subjects in Group 1 were exposed to a "suggestopedic" review procedure as modified by Mr. Lorne Cook, the students' science teacher, and similar to the final review stage or session (pseudo-passive concert) of the Lozanov Method. The suggestopedic review was led by the students' teacher due to his previous experience and familiarity with the procedure.

Students were first instructed to lie on their backs on the floor keeping their legs uncrossed, their arms at their sides, and their eyes toward the ceiling. The lights were then dimmed. The students were guided through a relaxation exercise in which they were asked to tense and relax each muscle in the body successively. Students were also asked to be aware of their breathing, taking deep breaths in, with slow exhalation. Students were then guided in an exercise called an "early pleasant learning recall" (Bancroft, 1988, p. 21) in which they visualized a situation from their childhood where learning was pleasurable (this may include the learning of a new sport or activity at camp for example). Once the students appeared to be relaxed, the material to be memorized was read aloud from the review sheet. Students simply listened to the information in a passive but alert state. Immediately following the first reading of review information, the pre-recorded Baroque music was played at a low volume as background music while the review information was read through a second time. While listening to the music and information being read aloud, students were instructed to breath in a 2:4:2 pattern (inhalation 2 sec., hold breath for 4 sec., exhalation 2 sec.). This breathing pattern was introduced into the Lozanov Method at the Lozanov Institute. Once all of the review information had been read, students were asked to open their eyes at the count of five.

Phase 3. Following the review of material in Phase 2, the students were re-grouped into one large group (n=40) to write the test. Students sat at individual desks spaced evenly apart in a well lit room. In front of each student, a copy of the test was placed face down. The students were then instructed to start, and they were given approxi-mately 1/2 hr. to complete the test.

At the end of the 1/2 hr. the tests were collected. Students did not sign their names to the test, however, they were instructed to circle either "group 1" or "group 2" printed at the top of each test.

Phase 4. Approximately two weeks after the initial testing, students were re-administered the same test under exactly the same testing conditions. No lesson review was given during this phase of the experiment. Following the testing, students were debriefed by the Experimenter.

Results. The means and standard deviations for Test 1 and Test 2 are presented in Table 1.

Table 1. Cell Means and Standard Deviations of Test Results

Group	Test Ave.	Test SD	Re Ave.	Re SD
1	12.67	1.84	14.87	3.11
2	10.06	3.68	10.48	5.49

As shown in Table 1, the mean recall score of subjects in the experimental condition (Suggestopedic review) was significantly higher on both Test 1 and

Test 2 than the mean recall score for subjects in the control condition (Traditional review). It can also be seen from Table 1 that there was a relationship between Test 1 means and Test 2 means for both groups in that retest (Test 2) means for both groups were higher than the original Test 1 means. This may suggest some learning took place between the two tests, perhaps during the debriefing or from extra studying, or test-retest practice.

A two-way Analysis of Variance (ANOVA) was performed to determine the effect of type of review [Suggestopedic (Group 1) vs. Traditional (Group 2)] , and original test (Test 1) vs. re-test (Test 2), on subjects' recall scores. Results are presented in Table 2.

As predicted, a significant difference was found between the two treatment groups for both test and retest scores. A significant difference was found between the combined Test 1 and Test 2 means of Group 1 (M=13.77) vs. the combined Test 1 and Test 2 means of Group 2 (M=10.25), (F(1,29)=9.34; p=.0025). Further tests were done to determine whether Groups 1 and 2 differed in terms of within-group, and between-subject variability. An Fmax test (McClaves & Deitrich, 1988) revealed that the calculated F exceeded the rejection value of 2.95. Therefore there was a significant difference between the variance of Group 1 (S2=3.38) and the variance of Group 2 (S2=13.53), (F(14,15)=4.00; p=.013). One interesting finding was that the Fmax for the Test 2 factor showed a significant difference between the

Table 2. Analysis of Variance of Test Results

Source	*df*	*MS*	*F*	*p*
Between Ss				
Review	1	191.49	9.34	<.01
Error1	29	20.51		
Within Ss				
Test	1	25.67	3.06	>.05
Review x Test	1	12.89	1.54	>.05
Error2	29	8.38		
Total	60			

variance of Group 1 (S2=9.70) and the variance of Group 2 (S2=30.13) (F(14,15)=3.11; p=.040). Perhaps this was due to individual differences, e.g. preferences for presentation of information.

Discussion. A review of the relevant literature showed that, to date, much of the previous research on Suggestopedia has tested components of the pseudo-passive concert session under the guise of methods of presenting new material. Perhaps Western research has not reported such astounding results as Lozanov and the Lozanov Institute, because the Method has not been tested as a whole. This is most likely due to a lack of understanding of primary source literature as presented by Lozanov and his colleagues. As stated previously, some of the problems surrounding replication of Lozanov's findings "might be somewhat alleviated by further literary research on the part of Western scholars." (Marcum, 1987, p.6). For example, it was pointed out that Lozanov (1978) states that his method is only effective insofar as its procedure and method are maintained in whole. However, since replication of the entire Lozanov method is neither feasible nor adaptable in lieu of North American pedagogy, it was suggested that the pseudo-passive concert could be used as a method of review and memorization. In following the pseudo-passive concert procedure as outlined by Lozanov, there is clearly no place for explanation or elaboration of new terms or facts being presented. Therefore, it seems apparent that the pseudo-passive concert session and its components are intended to yield results as a method of review only. An experiment was designed to test this hypothesis.

The results show that the Suggestopedic review group did indeed recall more definitions on both Test 1 (26%) and Test 2 (42%) than the Traditional review group. It may be concluded then, that the Suggestopedic review helped students to demonstrate an increase in knowledge acquisition, as well as an increase in memory retention. This supports the above stated suggestions that a slightly modified pseudo-passive concert session could indeed be adapted into North American pedagogy, and that such a review method may yield better results than traditional review methods, in terms of student recall abilities. Although Lozanov's Method was developed for the sole purpose of second language acquisition, further research could examine which areas of study could be used with the Suggestopedic review.

This study also examined whether the pseudo-passive concert session could be adapted successfully into a North American school day schedule with beneficial effects. This was achieved particularly well in the private school system which provides for a supervised "prep" or study period each afternoon. Providing a daily Suggestopedic review for students follows in conjunction with Lozanov's (1978) suggestion that material to be learned should be reviewed as soon as possible after presentation and explanation of the material. In this sense, the degree of external validity of this study could be considered fairly high.

Future research might examine which factors of the Suggestopedic review, such as dimmed lights and relaxation exercises, may serve as aids, helping students concentrate on the material to be memorized and helping to reduce distracting behaviors.

Future research should also consider that perhaps the Suggestopedic review actually helps to reduce variability in class means. Inspection of the raw data showed there was greater variability (range) in scores in Group 2 as compared to Group 1. Also, it is hoped that future research on Suggestology will consider primary source methodology more carefully. More precise application and testing of the Method as it was originally developed, may result in the establishment of effective and practical applications to North American pedagogy.

Appendix A: Review Sheet

N- Don Schuster	discovered 300% improvement in speed and effectiveness of learning
L- Jean Houston	this is the key to the 21st century: the brain has a limitless capacity, at 11 brain is 2X, doubled for girls; at 15 it's doubled for boys.
N- Roger Sperry	researched left/right brains
L-Leonardo Da Vinci	genius: evidence of synthesis of both sides of brain: he was an artist, mathematician and a scientist
S- Paul MacLean	author of the Triune brain
N- Luiz Machado	emotions are the basis on which memory is organized.
L- Mark Rosenzweig	demonstrated effects of an enriched environment on the brain

S- Karl Wittle	due to enriched environment, entered university at 9 yrs. and had a PhD at 14 yrs.
N- Dr. Terman	outstanding ability results in above normal physical appearance and behavior
L- Dr. A. Baddeley	explored short term memory
S- H. Ebbinghaus	research on memory. Produced learning/ memory curve
N- Von Restorff	you recall colorful, bizarre, funny, and vulgar things better
L- E. Tulving	Organization and meaning improve memory.
S- C. Schmidt	Use mental mapping: Brain remembers in context
N- Chris Evans	Function of sleep is to file and sort the day's activities: information is reviewed
L- H. Pieron	take frequent breaks when learning.

Appendix B: Test and re-test items

Don Schuster ______________________________

Jean Houston ______________________________

Epstein ______________________________

Roger Sperry ______________________________

Leonardo Da Vinci ______________________________

Paul Maclean ______________________________

Luiz Machado ______________________________

Mark Rosenzweig ______________________________

Karl Wittle ______________________________

Dr. Terman ______________________________

Dr. A. Baddeley ______________________________

Hermann Ebbinghaus ______________________________

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Resumen. Después de una revista de la literatura en Sugestopedia, el autor concluye que hay una gran controversia sobre su eficacia, y cree que la mayoría de investigaciones contrarias tengan un malentendido defectivo. Por lo general adaptaciones norteamericanas han usado componentes del tercer fase de Lozanov, la sesión especial (concierto pasivo), al

presentarles nueva materia a alumnos. Se sugiere que se puede utilizar esta sesión al revisar materia, pero no al presentarla de primero. El autor usó una investigación controlada al probar esta hipótesis. Las resultadas mostraron que los alumnos experimentales revisando con una sesión especial aprendieron más que los alumnos controlados revisando convencialmente.

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The Contribution of Background Music to the Enhancement of Learning in Suggestopedia: A Critical Review of the Literature

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ABSTRACT. The use of background music in teaching was the most innovative element in Suggestopedia. This paper reviews studies both within and outside Suggestopedia to investigate the effectiveness of music in producing positive outcomes in the learning environment. Significant positive effects of music during learning have been reported for vocabulary recall, reading performance and on-task behaviour. Positive effects of music played during testing, on the other hand, are not as consistently supported, although music during testing has also been less extensively researched. There is some indication that the best results are achieved when the same music is played during both learning and testing, suggesting that context-cueing may be responsible for the improved results. The facilitative effect of music on learning may also be related to physiological factors such as lower heart rate or increased alpha brain waves, or to affective factors such as the perception of the learning environment as more pleasant. There are also a small number of studies which report no significant effect of background music during learning or testing. While

the studies reviewed lend strong support to claims for the effectiveness of music from the classical and baroque periods, there is some indication that other styles of music, especially those sharing characteristics with the music selections recommended by German researchers, may also be effective.

Musique est la langue du cœur
Rousseau

I. THE ROLE OF MUSIC IN THE INSTRUCTION PROCESS

When Lozanov (1978) introduced a teaching method that he called Suggestopedia in Bulgaria in the 1960s, the genuinely innovative element which it brought to the classroom was the systematic use of music in the instruction process. During what were termed active and pseudo-passive concert sessions, which were part of a teaching cycle which included extensive introduction and elaboration sessions of materials in more conventional terms, learning materials were recited by the teacher to a background of musical pieces from the classical and baroque periods.

While the coupling of music and messages is extensively used in advertising and entertainment, music in education, outside official music classes, tends to be restricted to use with young children in kindergarten and primary school. Although words syn-chronised with music or rhythm are easier to learn than words alone, preparation of materials in this form with older children or adults is usually only found in music or drama classes, and perhaps in some language classes. The idea of a mathematics class relaxing to Handel's *Water music* while the teacher recites a list of formulae tends to elicit a variety of responses from today's educators, ranging from amusement to disbelief. This form of learning, however, is not new, and has been shown to be effective. As Rose (1985:97) points out, the coupling of music and the recital of words was already used by the ancient Greeks. Although the music used has changed, Suggestopedia has reintroduced the technique of presenting words and music simultaneously to enhance retention of materials.

Two major rationales for this can be identified in Lozanov's (1978) original work. The first is his belief that music has the potential to create a state of relaxed alertness in the students which he calls psychorelaxation. He found that the body rhythms of students adjusted to the rhythms of the baroque music he used, and he recorded a significant increase in alpha brain waves during the pseudo-passive concert sessions with a corresponding decrease in beta waves. He also recorded a drop in blood pressure and a slowing of the pulse. According to the relaxation and anxiety research discussed in Felix (1989), this state may be conducive to higher achievement.

The second rationale was based on the concept of whole brain learning. Lozanov (1978) believed that the interaction of both hemispheres together with the neo-cortex had a positive effect on retention rates of learned materials. Research by Claycomb (1978) supports this claim. Other models of brain functioning — the Triune Brain system (MacLean 1973), the Taxon and Locale Memory system (O'Keefe & Nadel 1978) and the Holographic Memory system (Pribram & Coleman 1979) — also suggest, according to Stein *et al.* (1982), that multiple channels of input will increase information retention. Strict lateralisation of music and language processing, as has been shown by Duffy *et al.* (1981), can no longer generally be supported since it has been demonstrated that different and extended areas of both hemispheres undergo changes during musical tasks (Petsche *et al,* 1985). While Duffy *et al.* (1981) suggested that language is processed by the left hemisphere while music is processed by the right hemisphere, Petsche *et al.* (1985) found that subjects listening to a Mozart symphony generated totally different topographic patterns of changes of the E.E.G. parameters studied. The latter's findings support the suggestion of Bever and Chiarello (1974) that the holistic appreciation of music of naïve listeners is usually processed by the right hemisphere, whereas musically trained listeners tend to use their "analytical" left hemisphere.

The most detailed research on the role of music in Suggestopedia has been carried out by Lehmann (1982, 1983, 1984) at the Karl Marx Universität in Leipzig. His work draws on the findings of music therapy, and his major conclusions are reported in translation in Lehmann and Gassner-Roberts (1988). Lehmann believes that the function of the music in Suggestopedia is twofold — to relax the students, but also to broaden and change their potential perceptions. He claims that "the change of perception through music can influence the attitude to learning" and "effect an expansion of attention" (Lehmann & Gassner-Roberts 1988:29).

Against the background of these physiological and psychological reasons for using music in the instruction process, does the research support claims for consequent improved results? This article looks in detail at studies which have investigated the effect of background music during learning or testing or both, and considers which type of music may be most effective.

II. RESEARCH FINDINGS

Effect of music on learning. Bordon and Schuster (1976) found that baroque music by Vivaldi and Bach resulted in a significant improvement in scores in a Spanish paired-associates task as compared to when this music was not played during the learning period in a laboratory setting. The findings for significantly improved performance as a result of baroque background music in a laboratory setting are supported by Renigers (1981), Baur (1982), and by Stein *et al.* (1982). In the natural teaching environment they are supported by Schiffler (1986) and Felix (1989).

While all the laboratory studies investigated the effect of baroque music on learning, Schuster and Mouzon (1982) also included romantic music for investigation. This study investigated the effects on the recall score immediately after the learning task and on retention scores 7 days later of three treatment conditions — (1) no music, (2) baroque music and (3) romantic music as a background to the presentation of rare English words and their definitions. Formats for the immediate and the delayed tests were not identical. In the immediate test, students were required to provide the appropriate definition of the words presented, which may be described as testing their recall ability. In the delayed tests, students were required to match words to the correct definition, which may be described as testing their recognition ability. Subjects were 228 volunteer college students divided into 18 treatment groups. They were sequentially given four vocabulary lists to learn, two of which were classified as easy and two as hard. Subjects' recall scores on a preliminary test were used as a covariate. Music was presented for three minutes before the presentation session and during the three minute presentation when the words and their definitions were read out aloud by the experimenter. Subjects in the baroque music condition received excerpts from Handel's *Water music,* while subjects in the romantic music condition received excerpts from Rimsky-Korsakoff's *Scheherazade* Suite, *The Young Princess and the Young Prince.* Subjects in the control condition had the same amount of time devoted to the learning task with the same oral presentation, but no music was played. The same conditions were reinstated during the testing. Affective ratings were also taken at various times during the experiment.

Findings showed that when music was played during the learning session, the control group had the lowest results, with the romantic condition next and the baroque condition performing best. All differences between groups were statistically significant for both immediate recall and retention. Music played during testing resulted in significantly improved scores for immediate recall but not for retention. The best results were achieved when subjects had learned with baroque music and had been tested with baroque music. The authors concluded that this condition was best because it also had the highest affective ratings for pleasantness and alertness.

These results suggest two possible explanations for the positive effect of music on learning. Firstly, they indicate that students experience the learning environment with a music background as more pleasant than with no music, and this may lead to improved performance. This view is held by Lozanov (1978), who refers to it as a "placebo effect", and Lehmann (Lehmann & Gassner-Roberts 1988:23) who refers to the work of Metzger (1961) on the close relationship between mood and achievement. Secondly, the findings show for the first time in this context that recall is positively affected by the reinstatement of the learning conditions during testing. Another effect, such as context-cueing, as suggested by Smith (1985), may therefore be produced by the use of music in the learning situation.

Smith (1985:591) states that a number of dimensions of background context, such as general physical environment (Godden & Baddeley 1975), drug states (Eich 1980), mood states (Bartlett & Santrock 1979), or background colours (Dulsky 1935) have been shown to be effective for inducing context-dependent memory. Smith (1985), independently of Suggestopedia, investigated whether memory is likewise affected by acoustic background stimuli. Subjects in this study were 54 volunteer adult students. No music/noise conditions were compared with Mozart, jazz and white noise. For the jazz condition two instrumental pieces entitled *People Make the World Go Around* and *Destiny's Children* were used. For the Mozart condition the *Piano Concerto No. 24 in C Minor* was used, and for the white noise condition noise recorded at subjectively similar sound levels from a white noise generator was used.

Smith's study consisted of two experiments. The first compared Mozart, jazz and quiet conditions, the second jazz, white noise and quiet conditions. Smith found that if music or white noise was used during learning then the reinstatement of the same condition improved recall performance. When learning took place in quiet conditions, performance was unaffected by the testing condition. Both experiments showed no significant differences between conditions on initial recall, but the first experiment showed that significantly less forgetting occurred in the condition which had Mozart for both learning and testing. The noise/noise condition was next, followed by the jazz/jazz condition with the quiet/quiet condition being last.

It is interesting to note that in Smith's (1985) study the white noise condition performed better in terms of retention of materials than both the jazz and the quiet conditions. These findings are difficult to interpret in the light of the conclusions of Schuster and Mouzon (1982) who felt that the music played may have produced a more favourable environment in affective terms. While subjects in the Mozart/ Mozart condition in Smith's (1985) study may have performed best because they felt best, it is difficult to imagine that subjects in the white noise condition would have felt better than either the jazz or the quiet condition since this type of background stimulus is usually either not consciously perceived or perceived as an irritant. This point emerges in a study by Jellison (1977), reported in Brislan (1986), which showed that subjects who received white noise as a background when placed in a stress situation reported significantly more stress than subjects who received background music. While both Bach's *Air on a G-String* and Dvoràk's *New World Symphony* had been effective in significantly decreasing anxiety scores on the State-Trait Anxiety Inventory (STAI), white noise resulted in significantly increased anxiety scores.

Smith (1985:600) explains the fact that music or noise can serve as a memory cue while quiet does not in the following way: One idea is that white noise and unpopular music selections are far less likely than quiet conditions to be encountered frequently during the 48-hr retention interval, and therefore should serve as more distinctive cues than the more common experience of relative quiet. Another idea is that subjects encode an experimentally presented music or noise selection, but they do not encode the absence of experimentally presented sounds any more than they might encode the absence of any type of stimulus, such as pain or food. This assumes, of course, that subjects are not expecting to hear experimentally presented background music or sound. At the time of testing, a replayed background sound could act as a memory cue if its encoded representation is associated with learned material, but the reinstatement of quiet conditions would not cue memory if there were no encoded representation of quiet.

While this is a plausible conclusion to arrive at in the light of other studies on context-dependent memory, it does not explore the reasons for the superiority of the Mozart/Mozart condition in this study, or the superiority of the baroque music in Schuster and Mouzon (1982). Perhaps there is an added effect of the subjects' liking of the background environment as suggested by Schuster and Mouzon (1982). Judging from polarity profiles collected by Lehmann (1982), it is quite possible that the Mozart condition was experienced as the most pleasant by the adult students in this study. Would this mean that teenagers, who generally prefer rock music to classical or baroque music (Felix 1987), would perform better with such music as a background to learning?

A study by Mullikin and Henk (1985) investigating the effectiveness of background music on comprehension performance in reading with 45 4th-8th grade children at a private school does not support this notion. No music conditions were compared to romantic and rock music conditions. For the romantic condition Mascagni's *Cavalleria Rusticana,* described as "a soft composition with a slow, methodical cadence" (p.355), was used. For the rock condition music from an album by a popular group (not further described) was used. The two music selections were administered at the same volume.

Nine children were randomly selected from each grade level. The sample was approximately half male and half female, and approximately one third was black. Each grade was tested separately in intact groups. The study was carried out over three consecutive days. Each day the children read one of 15 social studies passages of equal difficulty and answered 10 comprehension questions. During this time either no music or romantic or rock music was played. For each level the order of treatments and reading passages was randomised. Each child read a total of three passages and answered 30 questions.

Results were consistent across all grade levels. The rock condition performed the least well, with the no music condition next and the romantic condition performing best. All differences between conditions were statistically significant. It is interesting to note that while the trend for the two music selections was clear, there were 3 subjects for whom the rock condition yielded better results than the romantic condition. Although the results of this study show that romantic music is more effective in a reading comprehension task with teenage children, they also show that not all children are affected in the same way.

While the results of Schuster and Mouzon (1982), Smith (1985) and Mullikin and Henk (1985) suggest that certain styles of music are more effective in learning than others, caution has to be taken with drawing definite conclusions about which type of music may be most effective. There are not only distinc-tions between styles, such as baroque or rock music, in terms of tempo, melody, rhythm and timbre, but also between pieces within the same period, and between movements within the same piece. All too often, however, studies do not report exactly which part of a musical piece was used in the investigation. In Schuster and Mouzon (1982), for example, music was played for three minutes during the learning task, but was described only as Handel's *Water music* — a piece of 20 minutes duration with distinct variations in tempo, rhythm and melody. In the light of Lehmann's (1982) findings, it is possible that students react differently to the different sections of this work which range in mood from a solemn overture to cheerful dancing music, and in tempo from *adagio* to *allegro*. Similar variations can be found in rock and pop music. It is therefore important to know exactly which piece was used, since differences in rhythm, tempo and melody, among others, may have an effect on the outcome.

The differential effect on learning of musical pieces within the same period or style has been shown by Schuster (1985) in an investigation of the effect of various styles of background music on vocabulary learning with 256 volunteer adult subjects. The different styles were described as "baroque, classical, dissonant, Japanese, march, meditative and rock" — a description which highlights the problem of incomplete accounts of the music used. The study used a mixed analysis of variance (ANOVA) design with between-subject factors of type of music, music selection replication, suggestion, order of lists learned and subject gender. Dependent variables were as in Schuster and Mouzon (1982) — the immediate recall and recognition after 7 days of 25 vocabulary items per list, and affective ratings. One of the baroque pieces was identical to the one used in Schuster and Mouzon (1982). Schuster reports that neither recall immediately after learning nor retention scores were significantly affected by any of the background music when compared to the no music control groups.

However, there were significant differences between the individual pieces of music for recall scores. Two selections of each style were used, and the one topping the list for recall performance, after scores had been adjusted according to the pre-test performance, was one of the dissonant selections, a long way ahead of the baroque and classical pieces. However, the inconsistency of the findings is highlighted by the fact that the other dissonant selection was in 14th place out of 16! In the light of Schuster and Mouzon's (1982) speculations about a positive correlation between affective ratings of the condition in which learning took place and consequent performance, it is interesting to note that the dissonant music was rated the least liked of all music conditions in Schuster (1985). Unfortunately no information is given as to the relative affective ratings of the individual pieces within each style.

Why Schuster's (1985) study showed radically different results in terms of the influence of music on learning in general from the studies reviewed above is difficult to ascertain. The study was well designed and controlled. Schuster's main speculation was that background music is probably most effective in the suggestopedic setting, and would therefore be better investigated in the natural classroom environment. However, of the above studies only Schiffler (1986) investigated the effectiveness of music as a single variable in this environment. All other studies took place in laboratory settings or included other variables in the investigation. Interestingly, Schiffler's findings were the most conservative of all. Although he found a better performance with adults in intensive teaching settings as a result of using music in the instruction process, he reported a reduction of this effect when teaching took place for only four lessons a week, as is normal in the natural teaching environment.

Another type of music was investigated in a study by Davidson and Powell (1986) who looked at the effect of "Easy-listening" background music on fifth-grade science students' on-task performance. Twenty-six students were observed over 42 class sessions over a period of four months. Observations were recorded every three minutes. A significant increase in on-task behaviour was found for the total class and the male subjects. Although the female subjects also showed increased on-task performance, the effect was inhibited by a ceiling effect since the mean pre-treatment score had already been 99%.

No titles of the music used were given in this study. "Easy-listening" background music was defined as: "the type of music which has a melodic melody line over non-dissonant chordal structures and is non-percussive in beat. The orchestration is traditional in that there is a rich use of strings and winds. Easy-listening music is more lushly orchestrated than pop music." (p.30) Although the authors appear to be referring to pop music, this definition is not too far removed from Lehmann's (1982) recommendations for music selections for the concert sessions in Leipzig.

While Lozanov (1978) recommended a variety of pieces from the baroque and the classical periods, Lehmann (1982:15), after extensive research with polarity profiles, narrowed these selections down to an even more precise period (my translation):

> In the sense of a psychologically harmonising effect on the recipients, melodic slow movements of the early classical period and the Vienna classical period have been shown to be most successful in the practice of suggestopedia, that is, music which comprises a succession of slow movements, each with a characteristic melody, a melody so structured that, although different musical themes follow each other, an evenly calm and relaxed affective quality is constantly retained. The members of the Research Institute for Mnemology, in the light of findings in music therapy, attribute the suitability for suggestopedic purposes of the string music of the early classical period and the Vienna classical period especially to the fact that it is easier for the average listener to identify more quickly and profoundly with this music than with contemporary music, which is often experienced as cool and distant, and as complicated and intellectually charged. This statement should not, however, give the impression that music other than that of the early classical period and the Vienna classical period would be unsuitable for suggestopedic purposes.

As Lehmann himself suggests, it may not be necessary to adhere strictly to prescribed music selections since other types of music may share characteristics with the above. He suggests that "better pop music shows basically the same linguistic symbols as the music of the pre-classical period, the Vienna classical period and the early 19th century" (Lehmann & Gassner-Roberts 1988:30). There may also be a difference in affective reactions to different types of music between adult students and children. Lozanov (1978) claims that it is unimportant whether or not students like the music used. However, this view is not shared by the researchers in Leipzig (Lehmann & Gassner-Roberts 1988): they believe not only that liking the music is important, but that students' attitudes towards the music can be transformed from negative to positive as a result of taking part in a suggestopedic course. Lozanov's claim is further refuted by a study on children's attitudes towards music in their learning environment (Felix 1987) which showed that teenage students would be more receptive to Suggestopedia in their classroom if the music were more to their liking.

Effect of music on testing. While the majority of studies looked at the effects of music during the learning task, some studies have also investigated the effect of music during testing only. Results here, however, are not as consistent as they are with music during learning. Of the two studies already discussed above, Schuster and Mouzon (1982) reported that baroque and romantic music during testing had a significant effect on immediate recall but not on retention of vocabulary, while Smith (1985) reported no significant effect of classical music, jazz or white noise as a background during testing.

Render, Hull and Moon (1984), too, found no significant effect on vocabulary recall when baroque music was played during testing only. In this study four groups of volunteer undergraduate students (N=62) were given four multiple choice tests under four different conditions each: (1) guided relaxation before testing, (2) baroque music during testing, (3) a combination of both (1) and (2), and (4) neither relaxation nor music. Overall, findings did not show a significant effect for any of the three treatment conditions, although the general pattern was for the relaxation condition to perform high and the control condition low.

The findings of Render, Hull & Moon (1984) and Smith (1985), however, are not supported by Blanchard (1979) who reported significantly increased exam performance by students when "classical" or "rock and roll" music was played during testing (the author gives no further details about the music used). In this study 254 volunteer university students taking a traditional final examination were divided into three groups, equated as to students' age, weight and educational background. While the control group sat the 2.5 hours exam under standard exam conditions, the two remaining groups had either classical or rock and roll music playing in the background. All subjects' blood pressure and pulse rate were taken before, during and after the exam. Findings were that the blood pressure of the control group rose to a much higher level than that of either music group. The control group also showed much poorer recuperative activity of the heart after the exam while both music groups displayed excellent recuperation. Exam scores were 215.9 out of 300 for the control group, 250.9 for the rock and roll condition and 253.2 for the classical condition. The difference between the performance of the control group and that of both experimental groups was statistically significant.

Blanchard's (1979) results strongly support the use of music during testing, both for enhancing academic performance and for the physiological benefits associated with background music. However, the findings of all the studies discussed suggest that music during testing only may not be as effective as music during learning or especially during both learning and testing. The findings of Schuster and Mouzon (1982) and Smith (1985) indicate that the reinstatement during testing of the musical background used during learning may yield the best results in terms of retention of materials.

CONCLUSIONS

Judging from the findings of these studies, background music appears to have a positive effect in the learning environment. While most studies found a positive effect on the recall of vocabulary, one reported better reading performance and another better on-task behaviour associated with the use of background music. Of the ten studies which investigated the effectiveness of music during learning, nine reported significant positive effects either on short-term or on long-term memory. Of the eight studies which looked at the effects of music immediately after the learning task, six reported significant positive results. Of the seven studies which looked at the effects of music after 48 hours or even later, six again reported significant positive results.

The effect of music during testing has not been as extensively investigated, and findings are not as consistent as the above. While one study found a significant positive effect on performance when music was played during testing, two studies found no significant effect. Another study reported a significant positive effect of music played during testing on vocabulary recall when students were tested immediately after learning, but not when testing took place after one week. There is an indication, however, that best results are achieved when the same music is played during both learning and testing. Both studies which investigated the effect of the reinstatement of the learning conditions during testing found this.

In terms of the effectiveness of different types of music, the findings of the majority of studies discussed here lend some support to the special effectiveness of baroque and classical pieces, as originally suggested by Lozanov (1978). However, it must be pointed out that this type of music has also been most extensively used and tested. Other types of music have only been sporadically tested in the same context. All the same, the three studies which investigated jazz or rock music did not find these types of music to be effective in learning. One study, however, found rock music effective during testing. A study which investigated the effect of easy-listening music, which shared characteristics with the classical music found most effective for suggestopedic teaching in Leipzig, also found this type of music effective in improving on-task behaviour.

One caveat is that, when making statements about the relative effectiveness of music in learning, it is important to give either exact titles or a concise description of the musical piece or extract used. Failing that, it is not possible to state categorically which music is most effective in the learning environment, since it appears that the individual properties of the pieces are important factors in the outcome.

Although there is some support for the effectiveness of music in learning, we still know little about how the reported effects of music on learning are actually achieved. In the context of the studies reviewed here the effectiveness of music can be explained in several ways. Music appears to create a more pleasant learning environment in terms of affective criteria (Schuster & Mouzon 1982) which may improve performance. It further appears to have the potential to affect concentration and attention rate, and in turn improve on-task behaviour (Davidson & Powell 1986). Music also appears to be associated with physiological effects such as a lowered heart rate (Blanchard 1979) and increased alpha brain waves (Lozanov 1978) which may be instrumental in enhanced learning. Finally, studies which included the reinstatement of music during testing (Schuster & Mouzon 1982, Smith 1985) indicate that context-cueing may be involved.

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Resumen. El uso de música como ambiente en el enseñamiento era el elemento el más nuevo en sugestopedia. Este papel revisa estudios y dentro y afuera de sugestopedia para investigar la eficacia de música de mostrar resultados positivos en el ambiente aprendizaje. Significantes efectos positivos de música durante el aprender se han presentado por la memoria de vocabulario, el leer, y el comportamiento escolar. No se han sostenido tan constantemente los efectos positivos de música durante el probar, aún esto no se ha investigado tanto. Hay un señal que se logran los resultados

mejores cuando la misma música se toca durante ambos el aprender y el probar. Esto sugiere que información del contexto sea responsable. El efecto facilitante de música en el aprender también sea relacionado a factores fisiológicos como pulso bajado o aumentadas alfa-ondas cerebrales, o factores afectivos de la percepción del ambiente como más agradable. También hay un número pequeño de investigaciones que no presentan no significante efecto de música ambiente durante aprendiendo o probando. Aunque los estudios revisados dan fuerte apoyo a las pretensiones por la eficacia de música clásica y baroca, hay algún señal que otros estilos de música, especialmente ellos recomendados por los investigadores alemanes, pueden ser efectivos también.

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The effects of music and imagery on learning and attitudes in an industry training class*

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Abstract. This study investigated the effects of music and imagery on learning and attitudes in an industry training class. One hundred forty-six clerical workers were divided into eight groups and given classroom training on tax reporting. Two groups each were exposed to one of four conditions: 1) music only, 2) imagery only, 3) both music and imagery, or 4) control. Subjects were given a pretest, posttest, transfer task, and an evaluation form. While test scores im-proved significantly from pretest to posttest, there were no significant differences between any of the conditions on the posttest, transfer task, and two of the evaluation items. The imagery condition showed significantly higher scores on the evaluation item "evaluation of course content". However, the hypotheses were partially supported relative to the direction of the means in that the imagery condition and the combination of music and

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imagery were highest on the post-test, transfer task, and three of the evaluation items. Reasons for these findings are discussed.

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Introduction. It is estimated that industry spends more than $30 billion annually on training, involving 2 of every 3 workers and consuming more than 15 billion work hours (Huber, 1985). It has been used to teach people everything from operating the latest state-of-the-art equipment, to using new performance appraisal systems, to becoming more effective leaders. With such a broad spectrum of applications, it is no wonder there are a variety of training methods to choose from, ranging from on-the-job training to business games. Also, considering the sizable investment made in training, it is important for businesses to use an effective technique.

One of the most common forms of training is that of classroom instruction, where information is usually presented in a lecture format. Although the lecture method has been criticized, it does seem suited to the diffusion of information for immediate recall (Verner & Dickinson, 1967; Wexley & Latham, 1981). However, there may be ways to maximize its effectiveness in the work environment. For instance, the Suggestive-Accelerative Learning Technique (SALT), while most commonly used in school classrooms, may be applicable to industry training. This technique is generally used in conjunction with lecture. However, it also incorporates a combination of physical relaxation, suggestion, mental imagery, and dynamic presentation to enhance and even accelerate classroom learning (Schuster & Gritton, 1986).

Most research using this technique has involved elementary, high school, and college students learning subjects such as spelling, reading, and foreign languages. Its usefulness in training adults in the work force, however, has not been systematically or extensively evaluated. Altorfer (1983) has used suggestology, a technique similar to SALT, in seminars dealing with work relationships, people contact, and stress management. However, in these non technical training sessions, the emphasis was on self-motivation and attitude change, rather than on teaching work routines or technical skills. Schuster (1986) used SALT to teach a short course on paper characteristics to industrial paper users. He found that the class taught using SALT learned 80% more than the class taught conventionally. However, the sample size used in this study was very small and only two groups (SALT and control) were used. The purpose of the present study is to conduct a more extensive evaluation of the effect of two SALT variables, music and imagery, on learning in an industry training class.

Literature Review. According to Schuster and Gritton (1986), the purpose of mental imagery is to provide the student with more associations, and thus facilitate learning. SALT-related research suggests that imagery can enhance learning. For instance, Stein, Hardy, and Totten (1982) found that imagery combined with baroque music appears to increase delayed information retention. Schuster (1976) found that using unusual imaginal associations enhanced recall of rare English words. Other SALT-related research has found similar positive results. For instance, Schuster and Wardell (1978) investigated which features of suggestopedia can be omitted once students have used the method in learning. Only the variable of imagery plus sensory projection produced a significant drop in test scores when omitted. The researchers concluded that this particular variable is critical in maintaining superior learning. Other studies have used children rather than college students as subjects, with similar positive results (Caskey & Oxford, 1981; Groff & Render, 1983).

In addition to SALT-related research, other research on imagery has incorporated the use of various mnemonic strategies designed to enhance recall. For instance, Paivio and Desrochers (1979) found that an imagery-based hook mnemonic had a strong positive effect on both recall and comprehension of French words, with the subjects recalling about three times as many words using imagery than using rote rehearsal. With the imagery-based hook mnemonic technique, a person learning a foreign language would "hook" new vocabulary items to certain peg words by means of images. Other research has used the keyword method for improving recall. This technique involves the use of images generated to represent certain key words the person wishes to recall. Shriberg, Levin, McCormick, and Pressley (1982) found that eighth grade students who used the keyword method to remember names and accomplishments taken from short prose passages performed significantly better on a recall test than did control students.

Also concerning imagery, there has been some controversy about the effectiveness of bizarre vs. common images. It has been commonly thought that memory would be improved if the learner would try to produce bizarre mental images (Richardson, 1980). However, this idea has been challenged by many researchers, including Nappe and Wollen (1973), who found that bizarre images produced no more correct responses on a cued recall test of noun pairs than did common images. In fact, bizarre images took longer to form, suggesting that common images are more efficient. Einstein and McDaniel (1987), on the other hand, concluded that bizarre imagery can enhance memory performance but that there are boundary conditions to this enhancement.

Research concerning interactive vs. separative imagery is less controversial. In general, it has been found that instructions to use interactive imagery, dynamic imagery where images act upon one another, are much more effective than instructions to use separative imagery for improving recall (Richardson, 1980; Russell, 1979). Research has also been done comparing imposed and generated pictures with results supporting both imposed (Levin and Pressley, 1983; Shriberg et al., 1982) and subject-generated pictures (Schuster, Stavish, & Burchinal, 1976; Shriberg, et al., 1982).

In a review of the literature on imagery instructions in particular, Richardson (1980) has found evidence that the use of such instructions in learning verbal material has generally led to substantial improvements in memory performance. He states that long term or secondary memory is affected by the use of mental images. He notes that the majority of studies on imagery have been laboratory studies using very specific, mundane tasks. Thus, it may be that mnemonic techniques based upon mental imagery are of only limited value in assisting learning in everyday life, such as in a classroom situation.

Overall, it appears that imagery can be very effective in enhancing recall, although most studies have been laboratory studies so it is unclear whether such efforts would be effective in actual classroom situations. However, many types of imagery have been found to be effective, including, but not limited to, guided fantasy, imagery-based mnemonics, bizarre imagery, interactive imagery, imposed pictures, and subject-generated pictures. The present study examined the influence of imagery on learning in an applied classroom training setting. The forms of imagery used included bizarre and common imagery and were primarily imposed.

It has been suggested that music can likewise be used to help students learn better (Schuster & Gritton, 1986). As with imagery, it also provides more associations by furnishing an additional input to the right brain hemisphere. There are several types of music that can be used to facilitate learning. Of interest in this study are two: classical and baroque. Classical or romantic music is lively and varies in volume level and tempo. It is used during presentation of material in order to excite students and stimulate their imaginations. Baroque music, on the other hand, is generally relaxing, with a steady rhythm and volume level and is used during the passive review. Using music to relax students is meant to facilitate learning, since students are thought to learn better when relaxed than when anxious and nervous. Relaxation reduces the distractions, and subsequent hindrance of learning, caused by psychological tension (Schuster & Gritton, 1986).

Research has looked at the effects of supposedly "relaxing" music. Smith and Morris (1976) investigated the effects of stimulative and sedative music on the cognitive and emotional components of anxiety. Results showed that stimulative music significantly increased both worry and emotionality of college students. However, sedative music had no effect on anxiety, compared to the no-music condition. The researchers also reported that test performance was not affected by the music. Also, Logan and Roberts (1984) found that subjects listening to music by Halpern reported significantly higher tension levels than those subjects hearing no music.

It appears, then, that "relaxing" music does not necessarily result in lower tension levels. Irrespective of this finding, however, this paper is more concerned with the effect of such music on learning. Schuster and Mouzon (1982) evaluated the effect of two different types of music (baroque and classical) on vocabulary learning of college students. Results showed that subjects who heard baroque music during learning had the highest test scores, both for acquisition immediately after learning, as well as retention one week later. Those subjects who heard classical music during learning had intermediate scores, with those hearing no music having the lowest scores. Also, subjects who heard baroque music during learning and during the quiz were more relaxed, alert, and happier, according to their subjective reports, than subjects who heard classical music or no music at all. The researchers interpreted this finding, along with that of higher test scores for those subjects hearing baroque music, as evidence for the facilitation of learning when people are in a relaxed state.

Other studies have also reported positive effects of music on learning. For example, Stein et al. (1982) concluded that certain baroque music appears to be a contributing factor for increasing both immediate and delayed information retention, whereas certain baroque music combined with imagery appears to increase delayed information retention. Bordon and Schuster (1976) also found baroque music to be associated with higher scores on both immediate and delayed tests of vocabulary retention.

However, other studies have not been so positive. Render, Hull, and Moon (1984) studied the effects of guided relaxation and baroque music during testing on college students' test performance. Results showed no consistent effects for any treatment conditions. The researchers interpreted this result as implying that the use of music and guided relaxation may not be appropriate during testing only, but rather should also be used during learning and acquisition. Schuster and Miller (1979) found that, contrary to expectation, the use of music and an active, dramatic presentation style did not result in greater test scores.

The studies just described have primarily used baroque music, but other studies have investigated the use of various types of music or noise, and their effect on test scores. For example, Schuster (1985) conducted a laboratory study investigating the influence of many types of background music on the learning of vocabulary words. He used seven different types of music (baroque, classical, dissonant, Japanese, march, meditative, and rock), as well as a control condition. Also, there were two different music selections for each type of music. Schuster found no effect on acquisition or retention scores for type of music. However, there were significant differences in acquisition scores among the music selections for classical, Japanese, and dissonant music types.

Schreiber (1988) investigated the influence of background rock music on college students' achievement and found that the students in the music group earned significantly higher mean scores on examinations than those students in the no-music group. On the other hand, Zimmer and Brachulis-Raymond (1978) found no significant differences in student performance on an information-processing task between music and control conditions.

Overall, it appears that there is no definitive answer concerning the effects of music on learning, with some studies reporting positive results and others reporting no effect. However, it may be that other variables may mediate the relationship between music and learning. For instance, Daoussis and McKelvie (1986) found that extraverts and introverts respond differently to the presence of music. For instance, extraverts were not affected by the presence of music during a test while introverts' scores were significantly poorer in the music condition as compared to a control condition. According to the researchers, this suggests that the effects of music on cognitive performance are partly mediated by individual differences.

Redmond (1984) proposes a similar idea. She contends that, among other things, individual response patterns should be considered when selecting music. The same music may have different effects on different people, depending on their mood at the time. For instance, while quiet baroque music can enhance relaxation for some people, for others it may be a source of irritation when they are agitated.

To summarize the research on relaxation and music, it appears that supposedly "relaxing" music is not necessarily "relaxing". However, a slim majority of the studies reported here showed positive effects of music on learning. The present study will also examine the influence of music on learning, although the application here will be with adults in an industry training class rather than in a laboratory setting.

The Present Study. The present study investigated the effects of imagery and music on learning in an applied setting. Imagery was chosen as a variable because it has shown such promise in laboratory studies (Paivio & Desrochers, 1979; Richardson, 1980) as well as in SALT-related research (Groff & Render, 1983; Schuster & Wardell, 1978; Stein et al., 1982). It was hoped that such positive results would be replicated in this applied setting. Music was chosen as the other variable to be studied because the research results in this area are less clear. Given the time and resource constraints of doing a field study, these were the only two SALT-related variables manipulated in this study. A full-blown test of SALT in its entirety was not done.

Learning was assessed using both an immediate recall test and a transfer task. An immediate recall test was used in a similar manner as had been done in previous research on SALT-related variables (Bordon & Schuster, 1976; Schuster & Miller, 1979; Schuster & Mouzon, 1982; Stein et al., 1982). A transfer task was used to see if subjects could apply material they learned to a hypothetical situation they might encounter on the job. Research done in this area suggests that the use of imagery may enhance performance on a transfer task (Singer, Korienek, & Ridsdale, 1980). Traditional concepts used to maximize positive transfer include using identical elements, teaching underlying principles, and using overlearning (McGehee & Thayer, 1961). The concept used in this study is that of teaching underlying concepts whereby transfer is enhanced when the trainee understands the concepts, rules, or principles involved in a task. According to Goldstein (1986), this belief suggests that the training environment need not be similar to the transfer situation as long as underlying principles can be utilized.

Although the importance of assessing transfer of training is acknowledged, it should be noted that the transfer task used in this study is not a true test of the transfer of skills to the actual job setting. Instead, it is a simulated condition using a hypothetical situation. Also, the task is administered immediately following the training session, which may or may not reflect actual changes in on-the-job performance.

A subjective evaluation of the training class was also used in this study. This is in accordance with previous articles which have emphasized the importance of assessing trainee reaction to training (Kirkpatrick, 1977; Noe, 1986). Its purpose in this study is to determine if those participants exposed to music and/or imagery will report more positive reactions to the training program than those not exposed to music or imagery.

It is hypothesized that, compared to subjects in the control groups, subjects who were exposed to music and/or imagery:

1) will have higher scores on an immediate recall test of course content,
2) will have higher scores on the transfer task, and
3) will report more positive subjective evaluations of the training class.

The highest scores are expected for the combination of music and imagery followed by imagery only and music only.

Method

Subjects. The subjects in this study were 146 clerical workers at a large financial services company in the Midwest. One hundred twenty three were female and 23 were male. Ages ranged from 18 to 53 with a mean age of 26. Subjects were drawn from ten depart-ments within the organization.

Materials. A packet of materials was prepared for each participant. It contained an informed consent statement, a background information form, a pretest, a posttest, a transfer task, and an evaluation form.

Background Information. This form contained the following information: job title, department, sex, age, months at present job, and months at present company.

Multiple-Choice Tests. Multiple-choice tests were written independently by this researcher and an employee at the training site who was familiar with the course content. The items were based on the course outline developed by the instructor. Items were then edited by the course instructor and a specialist in item construction, and the edited items were combined into one list. The items were separated into two forms by this researcher and a training specialist at the training site, in order to have two roughly equivalent forms, Form A and Form B. Each form contained 31 multiple-choice items.

Transfer Task. This task was developed by the course instructor. It consisted of a description of a sample tax situation for a hypothetical person. Attached were hard copies of the computer screens the subjects use when entering tax information into the computer. There were five input sections with missing information such that subjects were expected to fill in the missing information, according to the information provided in the example. There was also one yes/no question, for a total of six "items" which needed to be completed by the subjects.

Evaluation Form. This form consisted of questions addressing the subjects' subjective evaluation of various aspects of the course. All items were rated on a scale from one to nine. Subjects rated the course content and provided their overall rating of the course according to the following scale: 1=very poor, 3=poor, 5=fair, 7=good, and 9=very good. The subjects' overall attitude toward the class was rated according to 1=very negative, 3=somewhat negative, 5=neither positive nor negative, 7=somewhat positive, and 9=very positive. Two open-ended questions were asked concerning the subjects' opinions about the major strengths and weaknesses of the class. Space was also allowed for comments of any kind.

Procedure. The instructor was trained by Donald Schuster, an expert in SALT. There were two four-hour training sessions held on consecutive days. During the first session, the instructor.was taught how to use both music and imagery, after which he was told to develop appropriate imagery for use with the course material he would present. The second training session was spent practicing each combination of treatment conditions along with presenting and reviewing the course material. Each treatment condition (music only, imagery only, both music and imagery, and neither music nor imagery) was practiced at least once or until the trainer judged the presentation to be correctly executed.

The topic of each of the training classes in this study was tax reporting. There were two classes or groups for each condition for a total of eight classes. Groups One and Eight consisted of the music only condition, Groups Two and Seven used imagery only, Groups Three and Six used both music and imagery, while Groups Four and Five did not use either music or imagery. Each of the classes lasted approximately 1 1/2 to 2 hours, and all were presented within a four week time period with two classes being held each week.

All of the participants were clerical workers, although there were several different job titles involved. One hundred sixty-two subjects were randomly assigned to classes. Twenty-one people were assigned to groups 1 and 2, while 20 people were assigned to groups 3 through 8. However, the people originally assigned to the classes were not necessarily the same subjects who attended those classes. For instance, due to schedule conflicts, from two to six people per class rescheduled the session they would attend, while from zero to 6 people failed to attend the class to which they were assigned. A total of 4 people declined to participate in this study. The resulting sample size consisted of 146 subjects.

Design. All classes were videotaped and conformed to the following format: Subjects were asked to complete the informed consent and background information forms, after which they were given the pretests. In all classes, half of the subjects completed Form A of the pretest while the other half completed Form B. Class outlines were distributed for use by subjects to take notes during the lecture. In all classes, the course material was presented by the same instructor using a lecture format, along with overheads of appropriate tax forms. However, the classes varied according to whether or not music and imagery were used. After presentation of the course content, the instructor described an example in order to illustrate the practical application of the material he had presented. Next, a break was given, after which the material was reviewed. Subjects were then given the posttests, transfer tasks, and evaluation forms. Those given Form A as the pretest were given Form B as the posttest. Conversely, those given Form B as the pretest were given Form A as the posttest. The transfer tasks and evaluation forms were identical for all participants.

Music Only Condition. During the music condition, classical music was played while the instructor presented new information. The instructor spoke at a volume the same as or louder than the music. Baroque music was played in the background during the review.

Imagery Only Condition. In the imagery condition, students were periodically asked to imagine particular scenes or images during the presentation phase. They were also asked to look at tax forms projected on a screen, with important parts highlighted in color, and to close their eyes and picture those forms in their minds.

Music Plus Imagery Condition. In this condition, both music and imagery were used, as described above.

Neither Music Nor Imagery Condition. In this condition, music and imagery were not used.

Instead, material was presented and reviewed using a straight lecture format. Overheads of tax forms were used, but did not have important parts highlighted in color.

Results and Discussion. There were no significant differences between groups on age, education, or experience variables. Coefficient alpha was computed using the posttests for both Form A and Form B of the multiple-choice tests. Internal reliability was demonstrated to be adequate, with a coefficient of .82 for Form A and .74 for Form B.

T-tests were used to determine if there were any differences in pretest means between Form A and Form B, for each of the eight groups. No significant differences were found. Thus, the tests were assumed to be equivalent forms, and the remaining analyses reflect this assumption. An ANOVA comparing overall pretest means (with Forms A and B combined) showed no significant differences between groups (F=1.13, p=.348).

Table 1 presents the group means and standard deviations for the posttest scores, transfer task scores, and the evaluation items. There were no significant differences between the groups for any variables.

Table 1. Group Means (and SD's) for the Posttest, Transfer Task, and Evaluation Items

	Group							
	1	2	3	4	5	6	7	8
Posttest	23.75	25.27	24.29	23.33	25.00	24.47	24.06	23.59
	(4.30)	(3.37)	(4.95)	(5.60)	(3.84)	(4.25)	(3.81)	(5.17)
Transfer task	3.13	3.14	3.00	2.00	2.87	2.89	2.44	2.41
	(1.59)	(1.46)	(1.45)	(1.53)	(1.51)	(1.49)	(1.72)	(1.54)
Evaluation ofcourse content	6.87	7.43	6.62	6.50	6.73	7.06	7.06	6.33
	(1.06)	(1.17)	(1.56)	(1.25)	(0.96)	(0.85)	(1.11)	(1.18)
Overall rating of class	6.80	7.14	6.80	6.06	6.40	6.12	6.61	5.81
	(1.08)	(1.23)	(1.73)	(1.30)	(1.12)	(1.76)	(1.58)	(1.60)
Overall attitude toward class	7.19	7.52	6.57	6.33	6.53	6.65	6.56	6.06
	(1.33)	(1.29)	(1.72)	(1.28)	(1.30)	(1.54)	(1.50)	(1.78)

Note- Groups 1&8: music; Groups 2&7: imagery; Groups 3&6: both; Groups 4&5: control.

Table 2. Correlations Among Dependent Measures

	1	2	3	4	5
1. Pretest					
2. Posttest	.51**				
3. Transfer task	.35**	.35**			
4. Evaluation of course content	.24*	.32**	.35**		
5. Overall rating of class	.20*	.28**	.38**	.72**	
6. Overall attitude toward class	.22*	.31**	.31*	.73**	.81**

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*Significant at .01 level.
**Significant at .001 level.

Table 2 shows the correlations among the dependent measures. The positive correlations between the pretest and posttest and evaluation items suggests that those people with higher scores on the tests evaluated the course more highly than did those with lower scores. This is especially true for the posttest, which had higher correlations with these items than the pretest. This is understandable since those who felt they had done better on the test would probably have a more positive attitude toward the class and its value to them. This also seems to be true for the transfer task.

All three of the evaluation items were highly intercorrelated, suggesting that those who felt the course content was good also had a positive attitude toward the class. Such high correlations may also suggest the presence of a halo effect. In general, the evaluations were above average, with a mean of 6.84 for "evaluation of course content", 6.49 for "overall rating of class", and 6.69 for "overall attitude toward class" (on a scale from 1 to 9). In summary, it appears that the participants tended to like the course and think it was worthwhile.

Table 3. Posttest Analysis of Variance

	SS	DF	MS	F	p
Between Subjects Effects					
Music	.13	1	.13	0.01	.941
Imagery	54.59	1	54.59	2.29	.132
Music by Imagery	8.62	1	8.62	0.36	.548
Error	3382.71	142	23.82		
Within Subjects Effects					
Pre/Post	5299.84	1	5299.84	663.18	.001
Music by Pre/Post	8.60	1	8.60	1.08	.301
Imagery by Pre/Post	2.82	1	2.82	0.35	.553
Music by Imagery by Pre/Post	10.58	1	10.58	1.32	.252
Error	1134.79	1427.99			

In order to test the hypothesis that the imagery and music classes would have higher posttest scores, a

2x2x2 mixed analysis of variance was computed using the presence or absence of imagery and music as between-subjects factors and the pre- and posttest scores as within-subjects factors. Results (shown in Table 3) reveal no significant differences for any of the variables.

However, within-subjects analyses revealed that test scores did improve significantly from pre- to post-training. An ANOVA was also computed using transfer task scores and the evaluation items as dependent measures. A significant difference was found on the "evaluation of course content" item for the condition of imagery (F=4.83, p=.030). No other significant differences were found. Also, the mean of the three evaluation items was used as a covariate to control for the effects of attitude. Presence or absence of music and imagery were the independent variables and posttest scores and transfer task scores were the dependent measures. No significant differences were found for any of the treatment conditions.

The videotapes were reviewed in order to determine if the music and imagery variables were used correctly. The instructor was consistent in his presentation of imagery procedures. However he adjusted the volume of the classical music several times during the presentation phase of Group 3. Also, he inadvertently played classical music for the first several minutes of the review in Group 6. Upon realizing his mistake, he changed the tapes and finished the review with baroque music playing in the background.

In examining the posttest, transfer task, and evaluation item means for each condition (music, imagery, music and imagery, and control), in all cases (except for the transfer task) the imagery condition had the highest scores (Table 4). For the transfer task, the combination of music and imagery had the highest score. The lowest scores occurred for the music condition (posttest and "evaluation of course content") and the control condition (transfer task, "overall rating of class", and "overall attitude toward class"). This suggests that the condition of imagery may have had some effect but not strong enough to produce significant results.

In a post-hoc analysis, those particular items in posttest Forms A and B which were directly represented by imagery techniques were analyzed separately using analysis of variance to determine if this subset would show significantly greater scores for the imagery conditions. However, none of these effects were significant.

Table 4. Means for the Posttest, Transfer Task, and Evaluation Items Broken Down by Treatment Condition

	Music	Imagery	Both	Control
Posttest	23.67 (4.69)	24.73 (3.58)	24.38 (4.57)	24.09 (4.88)
Transfer task 2.84	2.90 (1.53)	2.95 (1.55)	2.39 (1.45)	(1.56)
Evaluation of 6.60 course content	7.26 (1.13)	6.81 (1.14)	6.61 (1.31)	(1.12)
Overall rating 6.29 of class	6.90 (1.44)	6.49 (1.41)	6.21 (1.76)	(1.22)
Overall attitude toward class (1.66)	6.61 (1.46)	7.08 (1.62)	6.61 (1.28)	6.42

Note: Standard deviations are in parentheses below means.

Results of this study found no support for any of the proposed hypotheses. The only significant difference found was that of higher evaluations of course content for the imagery condition. Many different explanations could be proposed to explain the lack of significant effects. One of these is that the variables of music and imagery do not, in fact, have any effect on learning or attitudes. In light of previous findings (Daoussis & McKelvie, 1986; Schuster & Miller, 1979; Zimmer & Brachulis-Raymond, 1978), it was not necessarily surprising that music had no effect on learning. In addition, twenty people (out of 73 exposed to music) made negative comments on their evaluation forms regarding the music used during the class. The more frequent comments suggested that the music was distracting or made them sleepy. This supports the idea proposed by Redmond (1984) and Schuster (1985) that people may not respond positively to the music selections. Redmond (1984) contended that the same music can be relaxing for some people and irritating to others. This is evidence of the influence of individual differences which may moderate the effects of music. Also, as proposed by Schuster (1985), the particular music selection used may have more of an effect on learning than the type of music. In fact, the music only condition in this study had the lowest scores on the posttest and the "evaluation of course content" item than even the control condition. This situation may have been influenced by the particular music selection or by the distraction some participants reported the music to cause. The instructor also played the wrong music momentarily during the review for Group 6 and adjusted the music volume several times during the presentation phase for Group 3. (Both of these groups used a combination of music and imagery.) These interruptions may have influenced test scores and attitudes for these groups.

The lack of any effect for imagery is a little more difficult to explain, particularly in light of the many positive findings of previous studies (Caskey & Oxford, 1981; Groff & Render, 1983; Schuster, 1976; Schuster & Wardell, 1978; Stein et al., 1982). However, most of these studies were laboratory studies. Imagery has rarely been evaluated in field studies with adults. It may be difficult to apply imagery in a field setting. For instance, when material is presented in a lecture format, it is difficult to incorporate every proposition into a particular imagery technique. Although studies have successfully used imagery to enhance recall of prose (Peters, Levin, McGivern, & Pressley, 1985; Shriberg et al., 1982), these instances still tended to be very specific and did not involve an entire 45-minute lecture. Richardson (1980) points out that mnemonic techniques based on mental imagery, which have received considerable research support in laboratory studies, are very limited in their range of possible applications. However, in this study, even when those items directly addressed by imagery were analyzed, still no effects were found for the imagery condition. Thus, some other explanation must be found.

It is possible that the imagery used in this study was not appropriate. For instance, mnemonic keyword methods and imagery-based hook mnemonics, which have found considerable research support (Levin & Pressley, 1983; Paivio & Desrochers, 1979; Richardson, 1980; Shriberg et al., 1982), were not used. Instead, subjects were asked to imagine particular situations or were asked to look at tax forms projected on a screen and imagine them in their minds. Such applications of imagery may not be as effective as certain mnemonic keyword strategies.

Another possibility would be that a delayed test would have shown more effects for imagery. Such findings were reported by Stein et al. (1982) who suggested that multiple channels of input may have little effect on short-term retention but may still enhance long-term retention. Had the subjects in this study been tested again several weeks after the training course, effects for imagery may have been found.

It is also conceivable that the participants in the imagery conditions may not have used imagery even though it was incorporated into the lecture. They were not asked if they actually used the imagery or if it was helpful to them. In addition, Richardson (1980) and Slee (1983) suggest that people vary in their ability to form and control vivid memory images. Slee states that it is unrealistically hopeful to expect that all students will experience enhanced visual memory as the result of introducing imagery strategies into the classroom.

There were also some threats to internal validity in this study. For instance, since the training classes were spread out over four weeks, participants could have talked to each other outside of the class about the course content and/or the use of music or imagery during the classes. In addition, since subjects were allowed to take notes during the class, whether or not people did so may have had more of an impact on learning than either music or imagery.

Some threats to external validity were also present. For instance, only one company, one job classification (clerical workers), and one instructor were used. Also, most of the participants were female. There were too few males to make any valid comparisons investigating possible differential effects of music or imagery on males versus females.

It may be important to note that even though no significant effects were found for imagery, the imagery condition or the combination of music and imagery was highest on the posttest, transfer task, and all three of the relevant evaluation items. Also, transfer task scores and responses to "overall rating of class" and "overall attitude toward class" were lowest for the control condition. This suggests that imagery may have had some effect on learning and attitudes, but not strong enough to be significant. This is in spite of the comments from 6 people suggesting that they didn't like having to close their eyes or that the imagery techniques didn't work. However, three people made positive comments about the use of imagery. Thus, although only one significant effect was found for "evaluation of course content" in the imagery condition, the hypotheses were partially supported relative to the direction of the means. On the other hand, the music condition had the lowest scores on the posttest and responses to the "evaluation of course content" item, suggesting that the subjects' dislike of the music or the distraction it provided may have influenced their scores and attitudes.

The small difference in means for the imagery condition may not have been due to imagery's enhancement of learning, however. One possibility is that the novelty of the situation may have had more of an influence. However, the novelty of listening to music during a training class did not serve to enhance scores in that condition.

In summary, this study generally found no significant effect on learning or attitudes for either music or imagery. However, this does not completely eliminate the possibility that these variables can enhance learning. This study had several weaknesses which may have prevented these variables from having any effects on learning or attitudes. In addition, an application of SALT in its entirety may have resulted in greater effects, since it is possible that a combination of techniques is much more effective than using the individual techniques in isolation.

Obviously more research needs to be done in this area. For instance, little research has been done comparing particular imagery techniques. Also, it is obvious that the use of particular music selections and their like or dislike by participants needs to be addressed more systematically. In general, however, research still needs to continue in the effort to discover ways of making classroom instruction more beneficial. Although many training directors ranked it lower than many other training methods relative to its ability to achieve certain training objectives (Carroll, Paine, & Ivancevich, 1972), classroom instruction is still often the most expedient method to impart information to people. In addition, it is not always the "necessary evil" it is perceived to be, since it can be effective for acquiring knowledge. This study, in fact, suggests as much since test scores improved significantly from pre- to post-training. However, there may still be ways, imagery and music not excluded, to make classroom instruction more effective and to improve its stature as a reputable training method.

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Resumen. Este estudio investigó los efectos de música e imaginería en aprendizaje y actitudes en una clase en industria. Trabajadores oficinistas (n=146) se dividieron en ocho grupos al azar y se presentaron entrenamiento en reportaje de impuestos. Dos grupos se exponieron a una de cuatro tratamientos: música sola, imagenaría sola, ambas música e imaginería, o controlo. Los sujetos se presentaron una preprueba, una postprueba, una prueba transferible, y una forma evaluativa. Mientras las puntuaciones se mejoran significativamente de preprueba a post-prueba, no hubo no diferencias significativas entre ninguna condición de postprueba, prueba transferible y dos de las preguntas evaluativas. El tratamiento de imagenería mostró punctuaciones significativas más elevadas en la pregunta "evaluación del contendido del curso". No obstante, los hipóteses se sostenieron parcialmente en que los promedios de imagenería, y música e imagenería, fueron las más altas en la preprueba, prueba transferible, y tres de las preguntas evaluativas. Razones por estos fallos se discutieron.

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Sources of reference information on accelerative learning

The easiest access to published information on accelerative (-ed) learning, SALT, suggestopedia, and SuperLearning is through the ERIC system available in many university and college libraries. Write for microfiche or hard copy to: Acquisitions Coordinator, ERIC/ Center for Applied Linguistics, 1118-22nd St. NW, Washington, DC 20037. Phone 202-429-9292.

Secondary sources are *Dissertation Abstracts* and *Psychological Abstracts* along with the periodic author and title indices of the *Journal of the Society for Accelerative Learning and Teaching*. Chapter 3 of *Suggestive Accelerative Learning Techniques* (1986) by Schuster & Gritton [New York: Gordon & Breach] has an extensive review of the literature then available.

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